

January 2, 1961

# Aviation Week and Space Technology

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Grumman S2F With  
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### Kaylock, 'captive washer' nut gains wide acceptance!

Since its introduction early in 1960, this new Kaylock® lightweight, all-metal self-locking nut with integral free-springing metal washer has been specified by leading aerospace manufacturers for an increasing number of applications. Separate washers that used to drop off, roll away, and slide into hard-to-get-at places have been eliminated. The danger of short circuits, due to these forgotten washers, also has been eliminated by the new Kaylock HW14 nut-washer combination.

**Save Assembly Time:** Kaylock HW14's cut extra motion required to put washer on bolt. Washer won't drop off during application or removal. Cut time lost looking for wayward washers...to zero! **Safer:** New Kaylock HW14 "captive washer" nut employs the same, sure elliptical locking principle to prevent vibration hazards. The Kaylock HW14 is a development of Kaynak Mfg. Co., Inc., world's oldest and largest manufacturer of lightweight, all-metal self-locking nuts. For complete details, call your nearest Kaylock representative.



The Kaylock HW14 is  
available in sizes #8  
through #10 and in  
other sizes up to #2.

View of Kaylock  
HW14 and washer  
prior to assembly

Assembled HW14. No  
loose, free-springing  
washer can drop off.  
Danger of shorts is  
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AVIATION CALENDAR

- Jan. 11-13—Second National Symposium on Reliability and Quality Control, University of Illinois Hotel, Philadelphia, Pa.

Jan. 15-16—National Congress and Exposition, Society of Automotive Engineers, Civic Hall, Detroit, Mich.

Jan. 16-18—Annual Convention, Hispanic Assn. of America, Chevy Chase Hotel, Washington, D. C.

Jan. 16-18—Seventh Annual National Meeting, American Astronomical Society, Del. City, Okla.

Jan. 21-25—Winter Instrumentation Conference & Exhibit, Instrument Industry of America, Johnson Hotel and Kiel Auditorium, St. Louis, Mo.

Jan. 25-26—Annual Meeting, Assn. of Local Transport Authors, National Aviation Meeting, Atlantic City, N. J.

Jan. 27-28—17th Annual Meeting, Institute of the Aerospace Sciences, Hotel Astor, New York, N. Y. (Hudson Night Diner), 11th & 24th.

Feb. 1-3—Second World Military Electronics Conference, University of Alberta, Edmonton, Alberta, Canada.

Feb. 4—Solid Propulsion Conference, American Rocket Society, Salt Lake City.

Feb. 14-16—National Annual Symposium on Standardization, Testing of Aircraft and Spacecraft (Instrumentation), Society for Naval Eng., University of Texas, Southwest Research Institute, Hotel Del Rio, San Antonio, Tex.

Feb. 15-17—International Solid-State Circuits Conference, Institute of Radio Engineers, University of Pennsylvania, Philadelphia, Pa.

Mar. 5-8—Rockwell International, Conv. Center, Dallas, Texas, and Exhibit, American Society of Civil Engineers, see page 63.

Advances with Basic Induction

January 2, 1966

THE BOSTON HERALD, BOSTON, MASS., NOVEMBER 1, 1861.

**Postscript:** Please send three 35mm transparencies.

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## AVIATION CALENDAR

(Continued from page 5)  
Mechanical Engineers, Shoreline Hotel, Washington, D.C.

Mar. 9-10—Second Symposium on Replacing Thin Aircraft Structures, McDonnell Douglas, St. Louis, Mo., and Philadelphia.  
Mar. 9-10—Flight Progress Meeting, Institute of the Aerospace Sciences, Cleveland, Ohio (cancelled)

Mar. 13-14—Aviation Conference, American Society of Mechanical Engineers, Webster Hall, New York City.  
Mar. 13-16—Test, Operations and Support Conference, American Rocket Society, Stevens Hotel, Los Angeles, Calif.

Mar. 16-18—19th National Conference on Aviation Education, Mayflower Hotel, Washington, D.C.

Mar. 19-21—International Convention, Institute of Radio Engineers, Coliseum and William Penn Hotel, New York, N.Y.  
Mar. 23-24—1961 Western Metal Exposition, American Society of Metals, San Francisco, Calif., and Los Angeles, Calif.

Mar. 27-28—1961 Symposium on Transport in Measurement and Control of Liquids and Solids, Columbus, Ohio (Cancelled). For information, V.W. Shew, SA, 315 South High Street, Columbus 12, Ohio.

Mar. 27-31—Ninth Annual Flight Symposium, American Nuclear Society, Statler Hilton Hotel, Dallas, Tex.

Apr. 4—Aeronautics Teachers School, Massachusetts Institute of Technology, Cambridge, Mass.

Apr. 6-8—International Symposium on Electrical Properties and Fluid Dynamics of Gaseous Plasmas, Polytechnic Institute of Brooklyn, Brooklyn, N.Y.

Apr. 6-8—Using Remote Vehicles, Structural Mechanics Division, American Rocket Society, Palm Springs, Calif.

Apr. 7—National Automotive Meeting Society of Automotive Engineers, Commodore Hotel, New York, N.Y.

Apr. 10-11—Spring Meeting, Minnesota Association of Food Veterinarians, Association Division of Food Veterin. Co., Norwegian Beach, Calif.

Apr. 13-18—14th Technical Conference, International Air Transport Assn., Queen Elizabeth Hotel, London, England.

Apr. 16-18—Symposium on Chemical Reactions in the Lower and Upper Atmosphere, Standard Research Institute, Mark Hopkins Hotel, San Francisco, Calif.

Apr. 20-21—General Meeting, American Meteorological Society, Washington, D.C.

Apr. 20-22—Liquid Rocket Propulsion and Combustion Conference, American Rocket Society, Palm Beach, Florida.

Apr. 21-22—14th Annual American Astronautical Symposium, Institute of Astronautics, University of Toronto, Ontario, Canada.

May 8-10—National Seminar on Electron Devices in Communication, IEEE, Miami and Johnson Space Center, Houston, Texas.

May 19-21—Western Joint Computer Conf., San Jose and El Cajon, Ambassador Hotel, San Diego, Calif.

May 23-24—National Telemapping Conference, Statler-Towers Hotel, Chengdu, Szechuan, China.

May 25-26—4th French Congress on Aerodynamics, Le Bourget, Paris, France.



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To put the Minuteman's support equipment and associated equipment on rate was a completely new problem in missile handling. The first requirement assigned by Boeing to American Machine & Foundry Company and ACF Industries, Inc., was a feasibility study of the existing installations of railcars, rail, railcar operations and railcar storage. Design tactical cars are being designed under these limitations to carry the Minuteman missile, the missile and its operating equipment, safely isolated from residual shock and ready for immediate retaliatory launching.

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January 2, 1968

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**EDITORIAL**  
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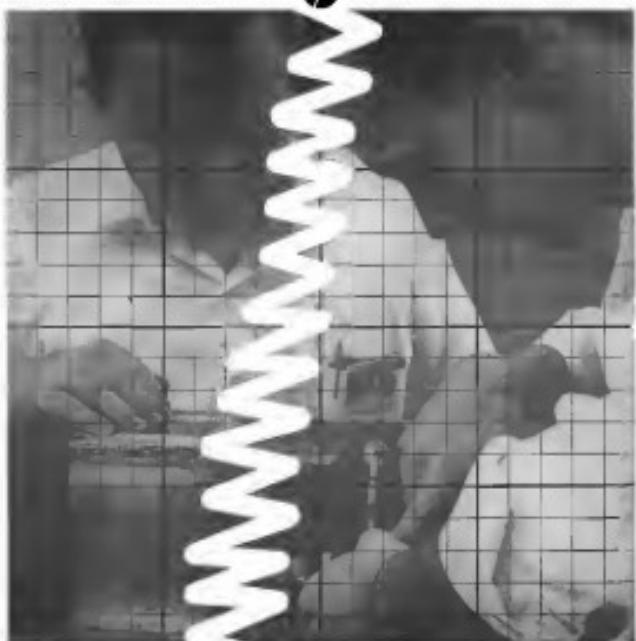
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## **EDITORIAL**

### **Thin Edge of the Wedge**

The launch of a Russian-made Ilyushin Il-76 transport to drop men and supplies to the Cuban rebels in La Gansa (see picture on page 23) should serve to emphasize again the manner in which the Soviet Union is using both its growing fleet of gas-turbine powered transports and its surplus of piston-powered equipment at the thin edge of what could develop into a powerful wedge for Soviet imperialism.

The startling growth of Soviet strength in air transport has been evident to even the most casual observer of the Aviatsiya scene during the just past three years. But there has been a tendency, particularly by U.S. airframe experts used to the technical refinements demanded by sharp commercial competition, to underrate the value of this Soviet transport fleet in the international arena. The fact that most of this Soviet equipment, both piston and gas turbine powered, would have difficulty in competing in the international airline market on purely economic terms has tended to divert these experts from the value of this equipment when narrowly dispersed as an instrument for expanding Soviet influence in the under-developed or politically fermenting countries of the world.

### **Economic Weapon**

The growing Soviet transport fleet is providing the USSR with a number of assets:

- First, it is making a tremendous contribution to the overall economic development of the Soviet Union by providing an element of transport and communication never before possible in the vast reaches of the 19 Soviet states.

- Second, it is providing Soviet military power with a mobility and flexibility it has never before enjoyed. The Western world has yet to feel the impact of this vital new factor in the Soviet military equation, but it is already there and must be reckoned with. The oil drops to Libya and the recent penetration of the Congo by Rhodesian/Rearmée Rhodesia are significant moves in this regard.

- Third, it is providing the thin edge of the wedge for eventual large scale economic penetration of key areas, paving the way for their eventual absorption into the Soviet colonial empire.

Although only a few years ago it was the fashion among U.S. transport "experts" to scoff at the idea that Soviet aviation equipment would ever be able to threaten in the international market, the initial steps in this program are now on the record for all to read. Soviet transport equipment has now penetrated beyond the satellite belt to Africa, India, and the Middle East. The poor economies of these exports is secondary to their carriers who have an urgent problem that only air transport

can solve, and of course, the political profit from these sales is equally computed by the Soviets in shaving their prices for this equipment or in amassing valuable battle data.

A good case history on the impact of this Soviet export drive was provided in the Dec. 12 issue of *Aviation Week* (p. 38) reporting on the growth of Glass Airways. In areas where the Soviet threat is too threatening for direct negotiations, the Czechs are active in selling Soviet transports and technical support to train operating and maintenance personnel. India, long dependent on British and U.S. aviation equipment, has become an unexpected recipient for Soviet helicopters and turboprop transports.

### **Darkhorse in An-10**

While the IL-18 turboprop transport probably has more appeal to new entries into the airframe field because of its resemblance to Western-type transports, we have long suspected that the An-10 and its later developments would eventually prove more attractive to these underdeveloped countries because of its ability to use grass and dirt fields, eliminating the requirement for expensive concrete runways. Technical development difficulties have retarded the introduction of this series even in Soviet civil and military transport fleets, but if its "bugs" are eliminated we may see other countries following the Indian example in buying advanced versions of this aircraft.

The air transport area is a particularly attractive one for political penetration because it provides an excuse to deposit Soviet technicians in the countries concerned and also provides an opportunity to long-haul nations to the Soviet Union for intensive training and exposure to its propaganda.

The air transport area is a particularly attractive one for political penetration because it provides an excuse to deposit Soviet technicians in the countries concerned and also provides an opportunity to long-haul nations to the Soviet Union for intensive training and exposure to its propaganda.

This is an area in which the manufacturing and operational skills of the U.S. aircraft and air transport industry can make a tremendous contribution to the underdeveloped areas of the world. It will take some more imaginative thinking than has been displayed thus far to develop a more effective program in this area and meet the growing Soviet challenge.

—Robert Holt



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## WHO'S WHERE

### Honors and Elections

Dr. R. Gopinath Sivam, professor of aeronautics and astronautics at Massachusetts Institute of Technology, has been elected president of the Institute of the Aerospace Sciences for 1981.

### In the Front Office

Dr. Hans R. Shultz, a director, American Research and Development Corp., Boston, Mass. Dr. Shultz is president of aerospace instruments laboratory, a division of Cado Electronics, Inc.

Dr. Jose A. Wiles, a director, Melpar, Inc., Torrance, Calif. Dr. Wiles is president of Pennsylvania State University. Also Robert E. Miller, vice presidential development development.

Robert E. Miller, a director, McCord-McCormick Aircraft, Inc., Philadelphia. Carl W. Johnson is the company's executive director.

Dr. Thomas H. Johnson, director, Technical Operations, Inc., Burlington, Mass. Dr. Johnson is a vice president and general manager of Raytheon Co.'s Research Division.

John B. Tuohy, vice president finance, and W. W. Reddick, vice president administration. Collins Radio Co., Cedar Rapids, Iowa.

Edward F. Sampson, vice president sales, marketing and distribution, The Puffett Co., Inc., White Plains, N.Y.

Frederick Davis, vice president planning and administration, Air Transport Assn., Washington, D.C., and John Horwitz, vice president, executive committee.

Stanley E. Bailey, vice president, Aerospace Research Corp., Alexandria, Va. Mr. Bailey continues as president of the recently established Stanley E. Bailey Division of Aerospace Research.

El J. Orosco, vice president and director general, aerospace International Division of Los. Inc., Santa Monica, Calif.

Neill E. Porter, vice president operations, Hawker Siddeley, Inc., El Cajon, Calif., and James Clark, vice president sales.

William H. Gandy, Jr., vice president, Strategic Airborne Products, Inc., San Francisco, Calif., a subsidiary of General Dynamics Corp.

Edward B. Coopers, vice president, test director, Aerospace Associates, Inc., Beverly Hills, Calif.

Albert W. Beck, vice president, Western operations, Robertson Public Contracts Control Co., Anthony, Calif. Arthur G. Beck succeeds Mr. Beck as director of marketing at the company's Anthony, Wyo., head quarters.

Mark J. Joseph, vice president, Data Computer, Mountain View, Calif., a subsidiary of General Dynamics Corp.

William F. Johnson, president, Terence, Inc., Visalia, Calif., has recently organized subsidiary of Cado Corp.

Donald Koenig, president, Molecular Electronics, Inc., New Rochelle, N.Y.

[Continued on page 58]

## INDUSTRY OBSERVER

► Boeing, Convair and Martin will conduct definitive studies for establishing and maintaining a potential base under contracts awarded by Air Force Ballistic Missile Division. Fended study work was assigned after an industry competition under SB-17512 (AW Oct. 20, p. 25).

► Martin is preparing a three-stage version of Pershing to National Armaments and Space Administration's launch vehicle. Company considers this advanced version of the existing missile would be competitive in price and cost with the Cruise-Vought system.

► Boeing is considering use of the Douglas C-133 for initial air drop test or Dyna-Soar to check the vehicle's glide characteristics. Boeing B-52 is scheduled to participate in the glide test program later in another format.

► Arms-Martin Pershing will begin tests with its Group III tactical type nose cone when current Group II nose cone tests are completed in mid-April. Developed and built by Martin-Baltimore for the Orlando Division, the older nose cone uses revised form of Element-based reinforced plastic. Group III nose is similar to the Group II but doesn't have the Group II model's television section.

► Convair high-altitude probe will be authorized over the Pacific Missile Range to make synoptic meteorological measurements. Program is conducted by Air Force Cambridge Research Center.

► Pratt & Whitney 27,500 lb-thrust Liquid hydrogen engine for the Saturn 5-A stage will be designated LR-108. Engine is an improved version of the 5,000-lb-thrust engine developed for the Centaur upper stage, which also will serve as the Saturn 5's stage.

► Initial deployment of Minuteman ICBMs will involve 165 missiles—85 in reduced set orbits and the rest in slots. Closed circuit television cameras will be used in the control spaces to monitor the missiles in their slots and slots.

► Boeing 727 narrowbody transport will be the first U.S.-built transport aircraft to feature a new generation of aircraft electronic equipment, the 8000 series, based on Cyclic function update. Advantage is reduced weight and complexity, and capability of providing cockpit control first through the use of variable hinge systems. Disadvantage is that reliability would have to be proven by Federal Aviation Agency in the use of the 8000 Avionics Configuration, now flying with all-hydronic irreversible controls.

► Nord Aviation has begun quantity production of the Matra Heliocopter Super Biennais, and first production overload flight is scheduled for mid-1981. Nord plans to produce 17 of the aircraft next year, and the rate is expected to reach a peak of four a month by January, 1983.

► Republic Aviation will build a facility to monitor effects of nuclear explosions in space at Air Force Special Weapons Center for Operation Constellation. Project involves antisatellite defense, and studies at the facility will investigate effects of nuclear space explosion residue to those produced by the earth's magnetic field.

► Sud Aviation is building the Alouette III helicopter, a more powerful version of the Alouette II with an 800-hp Turbomeca Astazou III turbine engine. Initial production planning calls for 200 Alouette, and French military units are expected to supplement export orders.

► Japan will begin delivering Kappa solid-propellant rockets midyear to Yugoslavia, starting in August if the export contract is signed between the Mitsubishi Peacock Co. and the Yugoslav Space Agency. Yugoslav engineers observed launches of Kappa rockets from Japan last summer.

► Data analysis of Mercury-Skylab 1 flight shows a 15-mi. extra range came from high winds, from higher-than-expected performance—with velocity slightly increased from the estimated 14,200 mph to 14,300 mph—and from longer braking time—3.3 sec. more than the planned 141 sec. Winds originally were considered safe near at the extra range (AW Dec. 26, p. 16).



**EMBLEM OF STRENGTH**, noted for its keenness of vision and range of flight, the American Eagle aptly describes the Navy's future long-range, air-to-air missile. EAGLE will mark a new era of anti-air warfare in which the high performance required is built into the missile itself rather than the aircraft that launches it. Development of the EAGLE anti-air warfare concept, for which we are prime contractor, offers new career opportunities for senior technical and management personnel.

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## Washington Roundup

### NASA Will Create Man-in-Space Center

One of the first choices in the National Aeronautics and Space Administration in reorganizing will be the creation of a Man-in-Space Flight Control Center around the Space Task Group, which has been managing the Mercury and Apollo projects.

This will be an attempt to give the group as extensive as possible strength and a direction that will allow it to take better advantage of technological developments in planning manned space flight for a period 15 to 20 years in the future.

Space Task Group was to have become a part of the Goddard Space Flight Center were Washington east the Mercury project was originally conducted. The plan now is for it to become an independent center, building gradually from 600 people to approximately 1,500, and remaining primarily a nonmilitary group with free research facilities of its own. Location has not been settled. STG now is based at Langley Field, Va.

Recent visit of Pierre Salinger, President-elect John Kennedy's press secretary, to the Air Force Missile Test Center in Florida has given missile and space workers there considerable hope that Kennedy also will take a personal look at Cape Canaveral and its support areas. Previous Eisenhower did not visit the Cape until Feb. 10 this year, despite frequent gold and hunting trips to Thomasville, Ga., some 250 mi. away, and there he left a bad impression with many engineers by staying only three hours.

### Space Launch Notice

Fiction of an attempted space launching no longer will be the first notice to others of the public that the civilian space agency is trying another experimental shot.

After two years of officially trying to discuss an incoming shot until after lift-off—explosives NASA now will release information about a shot ahead of each attempt. It believes the experimental nature of space launching may get more emphasis in detailed preflight stories, with the result that the public will become more aware of what competing NASA Administrator Keith Glennan calls "the substantial inherent probability of failing to accomplish the full intent of liquidified results."

NASA's former policy—formally rewording information used the day before a shot and then issuing press kits marked "Hold for launch"—was inferred from the Defense Department, where it didn't work either. This approach, intended to prevent a publicity "bustup" before a shot, was imposed by the Administration in the public relations plan that followed the spectacular explosion of a Vanguard test vehicle two weeks after Sputnik I was launched.

Central Intelligence Agency has been keeping a low profile on Soviet Russia's rocket deployment or "bulletin board." On more than 40 occasions since 1956, Russia has informed 15 different countries with distinction by sending various warheads.

In spite of Russia's recent claim that it has reduced its defense budget "considerably" for next year, CIA believes that the Soviets are spending about the same dollar amount in the U.S. as on military programs, that Russia will continue to build its war machine without being hampered by the cost of more consumer goods, and that this is reflected in an encouraging antigenic, typified by the solar share.

### Foreign Activity Probe

Mutual weapons development and U.S. assessments in foreign defense firms and facilities are being investigated by the staff of the House Government Operations Subcommittee on Military Operations, headed by Rep. Chet Holifield (D-Calif.). Hearings probably will be held early in the congressional session.

First report of the subcommittee, which pressed for reorganization of Space Technology Laboratories into a separate company in 1958, will deal with Aerospace Corp. This is the company that was organized to help manage Air Force missile and space programs in lieu of an STL reorganization.

Staff report on the feasibility of integrated regulation, ownership and operation of various forms of transportation has been submitted to the Senate Commerce Committee, headed by Sen. Warren Magnuson (D-Wash.), after more than a year of preparation.

Objectives by religious groups have forced USAF to look for another code name for Project Salvo, its proposed satellite interceptor. Those who oppose the name "Star矢" (which is derived from religion, but is particularly unattractive and inappropriate when applied to a weapon system).

—Washington Staff

# NASA, Defense Seek More Space Funds

**Both agencies ask 50% increase in next budgets; Johnson says military program to be strengthened.**

By Larry Boada

Washington—Both the Defense Department and the civilian space agency have asked the Eisenhower Administration to request Fiscal 1962 space research and development budgets 50% higher than their requests for the current fiscal year.

Meanwhile, Vice-President-elect Lyndon B. Johnson gave the first official indication last week that the Kennedy Administration intends to strengthen the nation's space program. This is significant in view of the battle brewing between the services and the National Aeronautics and Space Administration over which will dominate the U.S. space effort and get the lion's share of the space budget.

Concerning its space program goals, Johnson indicated no defense decision was now ready, but he said:

"The Defense Department has a very definite role and function in the field, which we recognize in the space act itself, and we must look to the services for leadership in space work. At the same time, we want a civilian lead. We do have the NASA group, and we try to coordinate those two groups—get the best from both."

For his talks with President-elect John F. Kennedy last week, Johnson estimated total space spending for Fiscal 1962 will be approximately \$3 billion, with perhaps up to \$5 billion by Fiscal 1965.

Defense officials appeared and sent to the Budget Bureau requests for Air Force, Navy and Army space research and development projects totaling \$637 million.

Next largest category, at \$222 million

reported by USAF for reconnaissance. This would go into the space surveillance program, which is now moving on to the advanced E-5 version. Navy requested \$11 million is this category for studies on its proposed Yo-Yo single path reconnaissance satellite (see p. 30).

NASA wants to spend \$125 million on its communications satellite program, including the prime Echo sphere and the active repeater satellite planned for communications experiments. Army wants \$63.3 million for the Courier and Alert series communications satellite programs.

For uncrewed space flight, requests include \$120 million for NASA's Project Mercury. Air Force initially asked \$146 million for its Dyna-Soar program and \$20 million for Aerospace Plane. USAF's uncrewed space flight budget was cut to \$121 million, and it would have to cover these two programs. Navy requests less than \$1 million for studies in this area.

For all space science investigations—that other than manned space flight and practical applications as weather and communications—NASA has requested \$32 million.

#### DOD Requests

Other requests submitted by DOD are:

- **Air Force:** \$90 million for the Air Force Manned infrared early warning system for detection of concentrations of battlefield forces.

- **Air Defense:** \$31 million for Air Force, probably used at for the Saint Anteope satellite, and \$3.3 million to Navy for project Slepper, a revised probe space probe.

- **Weather:** \$30 million to NASA for further development of the Trop and Nucleus weather association cameras.

- **Tactical space vehicles:** \$4 million to NASA for development of the Sea Scout shipboard launch system.

- **Navigational:** \$22 million to Navy for development and operation of the Trop and Nucleus satellite.

- **Cosmology:** Less than \$100,000 to Navy for studies on how to track escaping nuclei in use of nuclear detonations.

- **Computer research and development:** \$100 million to NASA and over \$1 million to DOD.

NASA requested \$41 million for supporting space research activities, and Air Force asked \$16 million for its research for management and other areas.

After his talks with Johnson, Johnson claimed the attitude of the existing administration on the reorganization of space. He said: "The

President-elect wants that program reorganized with a few basic goals with a view of determining what can and cannot be done. He does not want to specify whether he is going down that can be done, and he is determined that America large stand and occupy our place of leadership in that field."

Johnson and the space program review was now under way, but he did not say who was conducting it. Sen Robert S. Kerr (D., Okla.), who will take Johnson's place as chairman of the Senate Space Committee, participated in the review.

Kennedy seemed Johnson to be designation of the National Aeronautics and Space Council. He did not say whether the scope and character of this group's operations would be changed. Other members will be the Secretary of Defense, the Secretary of State and the NASA administrator.

## Mirage III Selected As Swiss Fighter

Swiss-Suisse government, reluctantly agreeing to earlier reports, will ask parliament to provide funds for the French production of 100 Mirage III-C fighter-bomber aircraft to defend the national air space. The Swiss government, which it understood to have offered to use its resources on imports of used Swiss aircraft—including fighter and interceptors—and return to us a new fighter for the Swiss air force.

Government, which had turned down the addition's request for the Murex on at least two previous occasions because of political considerations, agreed to the proposal during discussions here last week.

At the time, the then-new old aircraft had been reported to the Swiss as being too slow and unreliable. Since July 1961, both of which were determined to Swiss military and political leaders last month at Basle (IAW Dec. 19, p. 17), the decision has been based on Australian studies for the Mirage III (IAW Dec. 19, p. 17).

Preliminary approval of the unrealized appropriation of the estimated \$227 million, set aside to get the program under way, including the purchase of 100 aircraft, was given by Swiss Foreign Minister, who will be seated during the next session of the legislative body in March.

Initial contract may be followed within the next two years by an agreement for the licensed production of a substandard 100 Mirage III's in Switzerland.

Prime contractor in the production effort will be the French Aviation Peugeot (Aviation Peugeot), flagship of France, but a government spokesman said last week the "whole Swiss team" would be involved in the project. Final details of the production effort will be laid out after preliminary approval.

## Glenann Resigns as NASA Administrator

Washington—Keith Glennan resigned as administrator of the National Aeronautics and Space Administration for health, effective Jan. 20 when President Eisenhower leaves the White House.

Glennan will return to president of Case Institute of Technology. Dr. Hugh L. Dryden, deputy NASA administrator, might well be called to assume with the agency after Mr. Ira H. Berliner continues in the program and budget hearings. Glennan and Dryden's offices are the only two presidential appointments at NASA.

Dryden, 63, has a permanent research and engineering assignment for 42 years. In his letter of resignation to President Eisenhower, Glennan praised Dryden for his effectiveness in NASA's management.

Glennan served the White House a measure of high accomplishment since NASA was established on Oct. 1, 1958, including a revised budget for 1961. An urgent and difficult task in the original language this, achieved in one year, a flight qualification of the X-15 made it flightable if it could be in 1960, launch of a mid-size atomic communication satellite by October 1961 and flight test of the Rover nuclear rocket engine in 1965-67.

Prior political objections to the Mangi had continued largely around the fact that France is a member of the French SEATO committee, whereas both Sweden and Switzerland belong to the non-SEATO States. The Swiss also expressed, however, but strongly, feelings from the French government, which it understood to have offered to use its resources on imports of used Swiss aircraft—including fighter and interceptors—and return to us a new fighter for the Swiss air force.

Defence support through seven Bell-class and eight AGI class destroyers is estimated at \$52.347 billion. Of that, NASA will receive \$64.479 billion, and the service will absorb \$17.533 billion. Navy will absorb most of this cost in operating its fleet inventory force. Cost of aerospace service is 12 times \$17.533 billion, of which NASA is paying \$5.7 million.

Ar-Rashid and Development Contract award amounts is valued at \$57.7 million, including \$34.4 for inventory and service, and \$23.3 for Bell-McDonnell Division; \$5.2 million is awarded to the National Test Center and \$16.000 for service by the Air Proving Ground Center. Defense is absorbing \$22.6 million of the estimated ARDC cost.

Other major military support for Norway:

- Defense socio-economic activities operational and research, valued at \$15.9 million. Services will absorb \$1.19 billion of this cost.

- Shagosek Missile Range, research valued at \$1.8 billion, of which NASA is paying \$1.2 billion.

- USARF Air Review Service, for which NASA is paying all of the \$1.4 million estimated cost.

- Military personnel detailed to NASA's Space Test Center, for which NASA is paying all of the \$2.900,000 cost.

- White Sands Missile Range, for which NASA pays all but \$10.000 of the \$60.000 cost.

Other support comes from the Astronaut Training and Information Center, \$155,000; Army acoustics inventory vessel services, \$114,000; and government furnished equipment \$166,000.

## British Financing Vulcan-Skyhawk Work

Washington—Work on the testing of the USAF/Douglas Skyhawk made in the United States will be completed in 1962, and the British aircraft will make its first flight in 1963.

USAF reports helped the British Royal Aircraft Establishment support (RAE) the 26.5% Skyhawk development at its charge of being stretched and fit to meet in its present roles of lead and secondary \$15 million in USAF funds can be freed, because USAF is having trouble supporting the project from Fiscal 1962 funds. Fiscal 1962 money for Skyhawk also is in doubt.

Skyhawk is being developed both for the Royal Air Force and the Vulcan. Until now, USAF has funded the Vulcan adaptation work while negotiations were being conducted to determine the British share. The Vulcan work was being segregated separately from the overall missile project.

USAF's decision to withdraw funds brought about immediate release of the British money, but did not fully already exceed \$100 million. The American aircraft is being referred to within the Air Force as an "administrative goal." The joint project has received considerable criticism in Britain as to which jet it is primarily for British defense defense on a U.S. project that could be abandoned at any time.

Northrop Corp.'s Northern Division, which is developing the Skyhawk guidance system, has lost half of \$10 employees because of the Skyhawk cutback. Douglas will be off on the next two years \$40 manufacturing engineers already converted with Skyhawk, \$25 at Scotts Mosier, \$60 at St. Louis, \$20 at Long Beach and \$10 at Tulsa. In addition, Douglas will lay off another 1,000 employees at Long Beach since because of phase out of C-131B production and reduced DC-8 production.

# Broader Planning Role Seen for Defense

By Paul Eastman

Washington—More active role for the Defense Department in strategic and defense planning is indicated by the leadership of men named to the Pentagon posts by President-elect John F. Kennedy.

Defense officials chosen last week include Eugene Zuckert, Washington attorney and former Air Force參謀長 (assistant chief of staff) for research and development, who will succeed Robert C. Moore, attorney and former Air Force參謀長 (assistant chief of staff) for strategic and defense planning.

Kennedy has also named Russell Gehrke, who also has had sole expertise in both the defense and foreign policy fields, deputy defense secretary (AW Dec. 28, p. 21).

In picking his top Defense aides, Kennedy appears to be following closely the recommendations made by Sen. Henry Jackson (D-Wash.), chairman of the Senate Government Operations Subcommittee on National Policy Making of the Democratic National Committee.

Sen. Jackson said "a full and exclusive partnering of the Departments of State and Defense is the prerequisite of coherent political-strategic counsel for the President" to help him fulfill the obligations of his office.

Since he arrived as chairman of a

committee which presented a report for Sen. McCarthy on national security problems, Mr. Jackson has had a close and active role in coordinating defense and foreign policy planning. Gehrke also served as president of the Foreign Service Educational Foundation and trustee of Johns Hopkins University.

Zuckert also has a long record of government service, starting in 1947 when he became attorney for the department's liaison with the National Security Council and the Overseas Coordination Board. Assuming the appointment, Kennedy and Zuckert will play a key role in developing new defense policies.

Now joined Delliessi, Reed & Co., a New York investment firm, in 1949 and became vice president before he left to open his own financial consulting organization in 1958. In government, he has served since 1955 in financial director, Coordinator of Intergovernment Affairs, chief of morale and morale branch, Board of Economic Warfare, director of foreign procurement and congressional liaison, Foreign Economic Administration, and in special assignments to the White House.

From 1941 to 1946, he was vice chairman of the U.S. Strategic Bombing Survey where he was awarded the Medal for Merit, and in 1946 he was deputy director of the State Department Office of International Trade Policy. In 1948 and 1949, he was deputy to the assistant secretary of state for economic affairs, and in 1950 he became the director of the State

Department's policy planning staff. Mr. Zuckert was born in Newark, N.J., in 1917, and is a Harvard University graduate. He is president of the Foreign Service Educational Foundation and trustee of Johns Hopkins University.

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## Heavy Veteran

The 43-year-old attorney entered the Navy at 16 in 1941 and was assigned to the office of Secretary Forrestal. Later he was assigned to duty aboard the carrier Essex as a flight deck director, and he served in the same capacity aboard the USS Birmingham. He was promoted to the rank of captain in 1953 and served as commanding officer of the Frisco and the Lexington from 1956 until 1959.

When he left the navy he became an executive in the Austin, Tex., aircraft industry and commanded in 1964, the first aircraft not built locally, with probably seven at Bell. For the major portion of the engine evaluation program, the second is scheduled to be delivered to United Division of Central Motor Corp. for engine installation.

Now he has returned to application of the powerplant to its maximum horsepower and the shipboard impact load requirement for the new power plant is set as passing the 100-hour qualification requirement for 5,000-4,000-lb-thrust ratings between 1000 and 1100 rpm.

Bell is one of the contractors for the power plant and the opportunity to collect installation and operational experience with the powerplant at the stage of the prime testable. Engineers have concluded the step of getting the T63 into an engine an important milestone in the LGM-30 program. The company now has a contract to conduct assembly work on LGM-30 early.

Indication is given by Bell engineers that there is confidence in the T63 would be more beneficial if the power plant is inserted, just as the engine is in the plane for better weight savings also obtaining the need for a jog in the climb profile for the roll rates. Installation would make it possible to cut the length of the main static gear impacting the increased visibility. Old main would be lowered from the top of the engine section at a slow and probably be placed at the rear of the engine. The gear would be mounted to the engine and also radiating as follows:

Contract configuration on the T63-24 is made with minimum modifications so as to speed gathering of installation and operational data.

T63-24 project engineer J. R. Depold reports that no difficulties were encountered in installing the

# Allison T63 Turbine Passes First Trial Run in HUL-1M Testbed

Brent, Tex.—Short turbine runnability of the T63B Allison T63 turboprop, expected to play a significant role in the Army's light observation helicopter (LGH) competition, has provided a major breakthrough in reliability during ground tests at a Bell Helicopter plant.

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T63-24 propeller, and during the initial run the engine ran "smooth." The operating 30-hr rundown run will be conducted extramotored to provide data on the engine's performance and to fuel economy under combat power and other check points.

Propulsion endurance in all stages and over centrifugal stage and two intermediate runs with two stages. Powerplant is rated at 750-shp, but it reaches a 360-shp rating at 100% altitude. It weighs about 125 lb. That installation on the GH-1 competes with approximately 400 lb for the passenger-carrying LHX-300 installed in the HUL-1M and approximately 400 lb for the LHX-300 installed in the T63-24.

## Turbine Indications

Propulsion indicators that with the T63 installed the HUL-1M soft has a service ceiling of 10,000 ft at 1400 rpm, 12,100 ft at 1600 rpm and 14,600 ft at 1650 rpm. The gross weight of the two aircraft being 7500 lb. Useful load of the T63-powered HUL-1M is calculated at 1,930 lb in at 1,128 lb for the passenger payload + 414 lb for the T63-24.

Although T63 efforts do not compare much in the possibilities of being the T63 in the present war, probably because defense data and those of production targets are still not final, indications are that the T63 should have commendable performance in all fields. The company could follow up on some of several routes in taking the new power successfully if it won the LGM competition. The company may well be successful if it can take advantage of the LGM-30 entry.

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## Army Cancels Republic SD-4 Drone

Army canceled the Republic SD-4 Unmanned Reconnaissance Drone project last week, authorizing development will continue on the Fairchild 350 surveillance drone which has longer endurance. Both are based in the Fort Worth, Tex., area.

The Fairchild project will undergo a preflight test and flight test on the project in Fiscal 1961 fiscal year, the contractor has been told. The SD-4 was the original Unmanned Reconnaissance Drone project of Republic's Mobile Division, and 100 production models will be built at 500, but none will be retained for study programs under way at the division or in other divisions of the company.

The SD-4 had four main and first flight had been scheduled for the project in Fiscal 1961 fiscal year, but the flight did not occur. To date, \$14 million has been spent. Army says it costs for the conversion, mounting costs of the SD-4 system, need for three funds in other programs, and program mode in other donor programs. Army General is developing the unpiloted SD-2 surveillance drone, which also is funded.

Both the Fairchild and Republic drones are at Ft. Worth, Tex., where the Fairchild drone made its first flight last May. In the first of five flights, the SD-4 remained airborne 34 hr. One of the two was a launch failure, and in another a recovery parachute failed though the flight was successful otherwise.



Recovered MR-1 Mercury capsule is shown being lowered onto the deck of the USS Valley Forge by Marine Corp. HU-16 (Skidder 5-8) helicopter following pickup approximately 250 mi. downrange from Cape Canaveral, Fla.



## Recovered Mercury Capsule Received Only Minor Damage

Only apparent damage received by Mercury capsule which made flight Dec. 19 (AVW Dec. 26, p. 16) was broken outer layer of three-layer heat-resistant glass in one particle (right center, below). Above left, capsule is positioned on Army transportation vehicle. Paint on letters S and E is United States on Mercury capsule (above right) is believed lost NASA said this was not significant because this paint has a low melting temperature. Breaks in heat shield (below) are due to nuclear stress and not result of heating.



# Japanese Rearmament Plans Face Delays

TOKYO—Japanese Self Defense Agency—the only military organization permitted under the postwar peace constitution—is worried that its rearmament plans will be further delayed. While Japan's new law has the dollar problem.

Already moving in more moderate defense lines against the growing power of Communist China have been held up by opposition of the neutralist Socialist Party. But building of a respectable air, navy, and land tactical group totaling about 100,000 men has already moved ahead at the past five years with considerable U.S. aid.

Now of the U.S. and has been in the form of loans and grants. But the Japanese seem that increasingly the Japanese have been looking to the U.S. to supply part of the financing to get the Japanese defense industry back on its feet.

The project to rearm the Japanese is now P.104s, for example, will be partly financed by the Japanese and the U.S. The total project in the initial three-year stage will cost \$207 million. About \$75 million of this will be sent by the U.S. by buying 20 U.S.-built F-104s, 100 F-105s, and 100 F-106s for the first 10 or so planes under the program. Then Mitsubishi Machine Co. is to produce the remaining 170 in U.S. made equipment.

## Industrial Potential

But, surprisingly, Japanese defense officials and important sections of industry—aircraft, for example—have said "itself" the defense program in the Diet and the public on the basis of its current status of potential for Japanese industry. For example, American observers of the Japanese aircraft industry say that even including the \$75 million grant for the F-104 program it is potential over a three-year period beginning late next year.

The SDF has asked the Finance Ministry for a total of about \$311 million for fiscal 1961 in budget rearmament delays until toward late next year. But the SDF and other observers expect this figure to be trimmed back as it has been to previous years to above 18% of the total national budget. Although American observers are not sure if the Japanese will be willing to pay a greater share of their own defense costs (they have said between 21 and 35% of the gross national product), the pattern of a fixed percentage of the annual budget string itself is typical in the government's way all experts seem to have become the accepted principle on which Japanese conservative politicians are working.

Observers are divided in their opinion of what will happen if the U.S.—because of the gold drain—now ends to

cut its contribution to Japanese defense. The Liberal Democratic government of Prime Minister Hidemitsu Kanda cause had been faced with the same question earlier, too. For the opposition Socialist Party, but it failed to gain the two-thirds majority which would be necessary to amend the constitution and strike out the "no war" clause. Further more the Socialist Party gained an additional 21 seats—length, at the expense of the anti-Communist minority right wing Social Democratic Party. Within the Socialist Party the extreme leftists former members then strength.

All this seems to add up to a very cautious line on defense, as in other areas of the Diet. But the Diet is not the only place where the Japanese are in a tough position and a stubborn advocate of a pro-Western orientation for Japanese foreign policy. But it is not likely that he will want an all-out battle with the Soviets over the defense budget in the upcoming session of the Diet (mid-November).

American observers in Tokyo point out that there is no reason, just for the American contribution to the Japanese defense budget to be removed. Most of the U.S. contribution has been in U.S. made equipment.

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One basic problem of the SDF is the high cost of personnel expenditures in the total budget of the force. Wages now account for more than 60% of the agency's total expenditures. Recruits are being paid about \$95 a month, which is considered a very high figure

other than the Japanese buying new equipment in the U.S. Also the Japanese believe their military is more professional than the U.S. and the defense budget is smaller than the American military budget in Southeast Asia, as at least part of it. With Japanese defense industries set up through contributions from the U.S.—to meet some of the fiscal economy in quota for equipment under the U.S. Military Aid Program, the Japanese argue it would be easier to fill the Diet bill by buying the same equipment for the SDF.

One project that may be dropped if there is any American cutback is an anti-submarine helicopter carrier which the Japanese are interested in since construction in Freud 1967. The year's budget proposal contains a small item covering initial planning for the carrier.

The Finance Ministry has already let

it known that it opposes the project because the SDF has not come up with an overall program of expansion. An original five-year plan for expansion was dropped after the Koiso government fell in mid-1960 during the Seisenki Incident. The Japanese government agreed to take the U.S. base in the U.S.-Japan Security Pact. The SDF and others have refused to submit a new plan until they see what the nature of the new Diet will be.

Original plan for the carrier was for a 30,000-ton displacement weight ship which would be equipped with Sikorsky S-61 naval version helicopters.

Finance Minister's decision, nevertheless caused last week apparent financial difficulties for the Ministry of Heavy Industries, Reconstruction, Land, and Urban Affairs to produce domestically 90 Soviet Sikorsky S-60s. According to the initial plan of \$300,000 each, Mitsubishi said the first few S-60s coming out in mid-1963 will be manufactured here but the rest will be domestically manufactured except for some equipment. Estimated domestic production cost is about \$500,000 per unit.

If the SDF's budget is increased, the Japanese will go to Japan's aircrafts of NACA and the like for the helicopter.

The SDF planned to purchase those outright in the U.S. next year and move toward Japanese manufacture in the future. Also the Japanese had hoped to buy the electronics equipment in the U.S. for a general mobile electronic unit.

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high cost of personnel expenditures in the total budget of the force. Wages now account for more than 60% of the agency's total expenditures. Recruits are being paid about \$95 a month, which is considered a very high figure



Soviet Iluyshin Il-14 Shown Over Laos

Russian Iluyshin Il-14 transport with spill wings is shown flying low over Laos, about 30 mi. north of Vientiane, a Lao capital 60 mi. south of Luang Prabang, the capital on Dec. 21. It reportedly was used to penetrate weapons and supplies to pro-Communist rebels forces at Vang Vieng, 60 mi. south of Vientiane, after the rebels were driven from the capital.

In Japan, in order to compete against the higher wages now being offered by increasing Japanese industry.

Some high officials at the SDF are critical of the Japanese government's use of the defense budget in cost cuts, arguing that an elite force with excellent equipment is more expensive than meeting the total of 162,800 men now prescribed by the legislature which set up the SDF.

There has been no fixed rate of American contributions to the Japanese budget up, depending on the particular project. For example, in mid-November this year, the U.S. gave about \$60 million. American \$25 billion Japanese budget of the high degree of efficiency and technology in the Japanese shipbuilding industry in the F-104 program completed last year, the U.S. met the cost 93.50.

One plan set forth in the Japan-Okinawa Act, a solution of defense industry component, is that at least a portion of the Government Assistance & Relief to Occupied Areas separate be allotted to the defense buildup. Theoretically, the Japanese can set up

U.S. some \$2 billion for American aid extended on the immediate present need.

The Foreign Ministry has not announced if the new Diet government will agree to take up this particular idea when Washington comes home early that year.

Under the unenacted Japanese American security treaty signed last summer, the U.S. will give up the Japanese embassy toward support of American forces in Japan. If it is presented to approximately \$175 million annually (assumption was that Japan would pick up a larger share of its own defense costs) in the SDF.

The Japanese Foreign Ministry is committed to repaying the debt. It is assumed in Tokyo that because of the current gold drain, there will be more pressure to do so. The U.S. will have to bear most of the debt repaid in dollars.

But the Japanese would like to set

part of it used to help as contributions toward Japanese public projects involving defense, or toward American purchases of Japanese manufactured goods for third countries.

## Solar Flares Raise Atmospheric Density

Washington—Solar flares apparently affect the earth's atmosphere by increasing its density, according to a theory developed by the National Aeronautics and Space Administration as a result of a shift in the Earth's orbit during the winter solstice May 12. Evidence need dug on the space doubled during the life of the storm and increased the orbital period for about 100-400 miles of free space each Earth's passes through the outer Van Allen radiation belt, and NASA believes solar particles left out the hole heated the atmosphere in that zone and increased its density.

Reba was launched April 12 and after 12 days in orbit arrived in the U.S., Britain, and West Germany theorized that the atmosphere is affected by solar pass. Atmospheric density has changed the orbit of the probe from its initial 315,000 mi perigee and apogee to the current altitude of 410,135 mi.

# Dust Belt May Control Proton Intensity

New York—Existence of a terrestrial dust belt, rather than the limited strength of the earth's magnetic field, may be the controlling factor determining the intensity of trapped radiation-belt protons.

Controlling effect of the dust belt, a layer of micrometeorites which begins to have appreciable density about 4,000 km (2,500 mi) above the earth's surface, was postulated by Dr. Paul T. Sauer, University of Maryland, in a paper delivered to the American Astronautical Society at its latest flight symposium here last week.

Sauer said the density of the dust belt, which increases to a maximum near the surface of the earth, may also affect control that the atmosphere near the 4,000 km. level. Because of that, he said, the particles of dust "... may have a profound influence on the radiation belt problem."

The particles trapped in the inner radiation belt are said today to have originated with comets, ablated meteors, and their antecedents, controlled largely by the density of the ambient atmosphere. Normally, that would mean that intensity would increase with altitude.

But only prediction was made that proton intensity would show increases often between one and two earth radii, based on the located source of the earth's magnetic field to hold the high energy particles. That variation of intensity has been tested experimentally, Sauer said.

Only variation in which is the controlling factor in the intensity of the proton, earth range field of the dust belt, Sauer pointed out, is still a puzzle, but his explanation was plausible.

## AAS/ARS Merger Negotiations Stalled

New York—Merger negotiations between the American Astronautical Society and the American Rocket Society still were off last week at the AAS meeting.

No final agreement has been made by the AAS, but one official of AAS told Aviation Week that there was no major disagreement to reach the offer for either acceptance or rejection.

While official talks in full tilt for a merger, individual members of both societies feel that the cause says look. American Rocket Society has informed negotiators to continue with the formal creation of the AAS later this month.

That attitude, which put the AAS in a position to accept the AAS proposal was a part of their original AAS bid to the proposed merged group, the American Rocket and Astronautical Society, accepting those AAS members to serve on the AAS board. But the two and concurred terms independently, and continuing to pitch Progress in Astronautics, the AAS pressed.

The AAS members split the merger feel the smaller society would lose its identity, and that there is still plenty of room among professional societies for one devoted exclusively to the space sciences. They also feel that American Rocket Society would be the big winner with the word "astronautics" in its name.

able and could be considered the first explosion from the viewpoint of logic.

It would require about 20 psi of gas pressure to protect the crew of a caged spacecraft against the main belt proton radiation, according to a report written by T. G. Barnes, T. M. Parkerson and A. L. Barnorth of Grumman Aircraft Engineering Corp. That amount of stored gas would be enough to cover the total days of normal activity. It would not suffice until the requirements posed by a solar flare of the magnitude observed in May 1959.

To shield against another flare of that intensity would require about 5,000 lb. of shielding per man, a weight intolerable for space-craft specialists. Consequently, and the Grumman engineers, radiation protection is one of the most important factors in spaceflight design.

In a series of papers presented before NASA officials, studied as part of a general approach to an Apollo-type mission, which included a lunar expedition, would include a liquid oxygen tank, a double-walled, spherical liquid oxygen propellant tank.

Since the radiation problem can't be solved in the case of large liquid tanks, the next best thing is to avoid the problem. That brings up the problem of reducing the probability of surviving with a solar flare. While some progress has been made, the cost of a few percent for a tenfold lower solar flare risk than for a tenfold lower solar flare risk is high enough to pose problems in planning and navigation.

Five predictions may be feasible, said the Grumman team, using the work of Dr. K. A. Anderson for National Aeronautics and Space Administration. Among

Barnes' research, developed after careful study of 1,200 drawings of the sun's face made daily over a three-year period at the Athens, Greece, observatory, was used in anticipating flares by about two days. But this technique probably can't be used to extend predictability beyond about four days.

If this can't be done, manned space flights beyond the earth's magnetic field become a matter of applying rules theory to solve practical engineering problems.

## Space Mice: Offspring Unhurt by Radiation

Boca Raton, Fla.—Tex-Tech, offering of mice that survived space flight, generating extremely high radiation exposure, has been developed by a firm of scientists and engineers from the National Space Center, located in the USAB School of Aviation Medicine who have been managing the project.

The three mice, Miss Amy and Bob, were lifted 680 km high and traveled some 4,000 km down from Cape Canaveral to American Island in a 16-hr. shunting capsule with the nose cone of a Convair Atlas missile on Oct. 11.

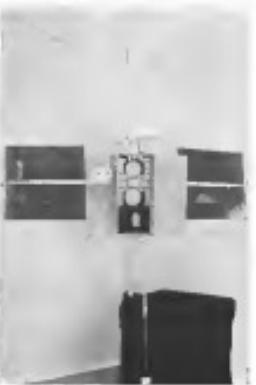
Flight duration from launch to splash was approximately 30 min.

During the traverse the space experiment penetrated the lower Van Allen belt during the upward and downward phases of the flight and the mice were subjected to more than 1 hr. of damage of heavy primary particles, according to instrumentation. This is less than the dosage normally experienced by a human being in a short X-ray treatment.

Apparently in terms of this radiation exposure, the mice are three weeks after recovery developed some ratty and single hairs of white hair. Following recovery the female mice were bred with Miss Amy, usually delivered live mice and the following day gave birth to a sixth, sufficient mouse.

The live monkeys show no genetic traits of their parent's space experience, according to Dr. Hans G. Klimstra, chief of the Department of Space Medicine, Wright Air Force Base, Ohio, who is the parent of the mice. There is no expression of genetic effects on offspring in probably as several weeks. He added.

The fact that there was a stillborn mouse in the litter is considered in significant here, since the usual litter of mice is generally very small and it is not unusual for mice to have three or



Orbiting Geophysical Observatory Details

OGO satellite in orbit, with solar panels folded. At left, satellite will weigh 1,600 lb., with power potential to 1,600 W including a 100-lb payload experiments. Orbiting Geophysical Observatory (OGO) at right shows standard components in light colors, experiments in black. Space Technology Laboratories, Inc., recently was a \$31 million contract (AW Dec. 23, p. 24) to build three of these satellite packages.

the few litter in several weeks to be successful.

Of particular concern to scientists was the fact that the mice two weeks after recovery developed some ratty and single hairs of white hair. Following recovery the female mice were bred with Miss Amy, usually delivered live mice and the following day gave birth to a sixth, sufficient mouse.

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The mice experienced from approximately 16 to 20 times the radiation dose of a person of approximately 45 yr. Dr. Klimstra reported. Although these are high and long-exposure doses, he noted that mice are extremely capable of handling high doses and are known to have tolerance roughly 10 times those of humans. Indications are that the rate of mice experienced very close to their upper margin of tolerance during the flight.

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## News Digest

Air Force canceled Anti-Emissary Research Laboratory's \$6 million contract to develop a stratospheric drag balloon test vehicle, following budget and technical issues.

For U.S. Air Force—the 25th Air Force's 5th and 10th Verbal 44-hour jets, delivered to Barksdale as a result of Soviet Premier Nikita Khrushchev's 1958 visit to the U.S. President, the five 5th jets and one of the Verbal 10 will be used as executive transportation for top Soviet officials. The other Verbal 10 is in the modified airframe version. The 5-10 jets, the Verbal 19, both companies trained Soviet pilots and mechanics and are prepared to fly Soviet jets. No other company refrigerates fighter aircraft.

Bell Helm. Research Corp. contract for the structure for the orbiting solar observatory (OSO-3) is under negotiation with National Aeronautics and Space Administration. Detached OSO payload is designed S-16 by NASA. Bell Helm has been studying ultrahigh-vacuum cold-trap for the mission under a contract awarded a year ago.

Northwest Airlines was rescheduled to resume partial DCA package service

last week, with temporary personnel serving as flight engineers pending replacement of its 75-day-old cargo of 475 International Assoc. of Machinists flight engineers (AW Dec. 23, p. 41). First flight was to operate Seattle Chicago-Minneapolis.

First building-airframe installation of new 1000hp Allison 733 turbine will be turboprop-driven on early model Boeing L-21 (Model 10-Turbosuper) to be made by the engine manufacturer as engine supplanted so far in the U.S. Army.

Glennie M. Bellanca, 74, died last week in New York. He designed the Wright-Bellanca monoplane Columbus which in 1927 set an endurance record of 51 hr 11 min 25 sec and was the first aircraft to fly the Atlantic with a passenger. He founded the Bellanca Aircraft Corp., which he sold in 1934.

Boris Chervonik, Soviet aircraft designer, died Dec. 17, at the age of 64, according to Interpress.

Explor III short-mission ionospheric satellite, launched Nov. 3, went silent Dec. 27 after 17 solar insolation weak and instrument signals for several days. Ministry battery power supply had 2.5 minutes estimated lifetime.



1989. Net operating income for the industry was only \$14 million, down sharply from the \$103.2 million figure last year.

Aerospace Airlines has attributed the poor industry showing to general economic developments during the year which the carrier and had the effect of slowing down the rate of growth of airline traffic. Aerospace forecast a modest growth for domestic airlines in 1990.

"General economic developments are likely to continue to have a downward bearing, [as] far as the first half of the year. Traffic growth will be reduced in the second half if the expected upturn in general business activity materializes."

The airline believes that continued

improvement in equipment and service is in the past will generate a more rapid growth rate for the industry than for the economy as a whole. The carrier also feels traffic growth will be further stimulated by the increased speed and comfort of the new aircraft equipment now being introduced by the airlines.

Also listing an effect the impact of the airline cutbacks over New York (AW Feb. 26, p. 38) will have on traffic remains to be seen. However, highly polished standards tend to make deep discounts less attractive to passengers and a period of time (AW Feb. 26, p. 38). For example, the 1976 airline cutbacks over the Great Gatsby brought no immediate decline in traffic growth that slowed down airline business activity for close to three months.

For the final determination of all subcommittee matters, with a two-thirds majority by the full Board vote on the request of one of the parties concerned.

Pointing out that an "interim" dairy in handling state cases and "extraordinarily complex" proceedings may require extension of CAB, Landis charged that the Board permits too many states, such as "political entities, stateboards, business and associations, to become involved in hearings." He added that the Board should end its use of the basic term "arbitrator." Much of this information could be determined beforehand by "less legalistic and reasonably sensible" methods, leaving the role "judicial" consideration by the Board the issue of which competing carrier should be selected for the route in question. If necessary, full CAB hearings could properly be held in strip-jurisdiction studies where "a sense of shortening due process," Landis said.

Major implications should be handled in a similar manner, the report said, and they should be considered in relation to a planned transportation plan either other than or as a result of financial problems of one airline involved in the dispute of the second carrier to "try a higher prior for a certificate" than another airline.

#### Certificates "Burdened"

"Unfortunate," Landis said, "the Board has hamstrung itself so as to preclude the use of transportation certificates freely given to carriers by the government to become a subject of battle in the courts and then let go in the auction block to be sold in the highest bidder for a price which the public is obviously bound to pay."

Acting as the airline industry's "lobbying as the worse state," Landis said the CAB has been "burdened" by its participants' insistence on the "independence of national transportation." He favored this position particularly at the Board since because of the President's power over international routes, noting that the only "way" for the situation in presidential self-government "which has been lurking in the last two Administrations."

A lack of air waybill planning in CAB also is critical, he said. While centralized air waybill planning could lead to the creation of a more efficient system, it would not eliminate the need for individual shippers to have to go through each airline or cargo agent for each appearance of air transport, except those *foreign* companies by presidential order.

At the same time, the report and any accompanying plan should provide for a delegation of authority to panels of agency members or hearing tri-

tees member with a small staff to handle the task along with representatives of the state Department.

Landis also raised the question of CAB's continuation of "public interest," which he considers two often has become a matter of "semantic intent" as a direct result of an need to maintain a close contact with the airline industry.

"As an example, he cited the Board's "source function" in approving the principle of subsidy passivity to local service carriers while forcing them to non-schedule and change routes."

#### Cargo Development

Pointing out the potential interest in the development of an cargo service, Landis said the "freightway toward state subsidies" could largely be avoided through the appointment of a "public counsel" whose function is an independent third arbitrator to his capacity to resolve agency disputes. Such a council should have the right to request an agency review of air hearing decisions if necessary, but would not be granted this right in cases already officially decided.

A "prime key" toward improving any administration's success in the attempt of attracting qualified personnel, Landis said:

the CAB now finds itself faced with potential negotiator that under the present of financial exigency may face changes in route patterns and route structures due to changes from the time otherwise have been deemed desirable. With plans with a March 2, 1990 study on the drawing boards, planning far beyond the conventional jet is necessary. Re-evaluation of our theories of international air rights and routes should similarly now be in process."

Landis added that the value of aircraft in cargo carriers who has raised the question of whether it might be more in the public interest to spend the subsidy now going to local service passenger carriers or cargo operators.

In its comments on the CAB, the Board's overnight subcommittee had focused its concentration too much on the airline industry's economic problems and not enough on the interests of its users. The subcommittee still recommended a \$10,000 fine as five years imprisonment or both for an air fare official board negotiator in an air-cargo decision.

#### Shortening Procedures

To shorten the Board's lengthy administrative procedures, the still also urged that airfares not be permitted to change more than 25% of their costs in these proceedings for subsidy, and pay its users' portions.

If the cost of these lengthy proceedings did not permit economic proceeding had to be borne by the air carriers involved, then as so do that they would be properly satisfied at the price of the airline user economy," the report said.

#### Local Airlines to Get New Subsidy Formula

Washington — Civil Aviation Board officials were suggested by Landis as a means of ensuring that smaller plane manufacturers to local service air carriers by the end of this month.

Pending formal adoption of the new proposal, which applies to a new CAB ruling effective for 20 carriers, CAB has placed all 13 local service carriers on open bid rates.

In other sections of its report, Landis further criticized Civil Aviation Board's lack of air planning to calculate the impact of jet aircraft on the airline industry's future.

"The impact of the jet plane, substantially implying the capacity of progressively greater weight on our domestic and international route structures," he said, "has removed an serious consideration despite the obvious threat that the advent of the jet plane for the portion of many of our intermediate trunk carriers. Instead of forced route planning,

of flight service, with a maximum subsidy rate of \$1.05 per available seat mile potential on the order of 300 revenue plane miles daily, plus 10% for route miles demand, or the volume of service increases with a CAB proposed subsidy level of 600 revenue plane miles per station, pending \$1.90 per available seat mile rate.

In addition, the plan contains a profit sharing feature requiring that varying percentage of profits earned in excess of the 12.75% rate of return fixed for the local service industry be retained by the government.

#### Scandinavians May Offset SAS Losses

Stockholm—Dansk, Norwegian and Swedish governments are investigating proposals to help Scandinavian Airlines System offset an estimated \$5-million deficit incurred in 1989 plus additional losses reported over the next few years. Local, actual and anticipated, we've started primarily to jet equipment producer and the foreigner in our market share. On the other hand, official and let work that the overall number of passengers carried in 1989 showed a 16% increase from 1989, "but operational increases have been less likely."

Matters of compensation and finance must have settled with SAS officials last by President Ali Babacan to discuss ways of providing the airline with up to \$10 million to help it expand its working capital, gain control of its personnel and \$10.5 million and pay its employees for the next few years. It will jet field DC-9s and Boeing Companys and plan no additions to the Convair 900 in Middle and Far Eastern routes next summer.

#### SAS Over Russia

Copenhagen—Scandinavian Airlines System last week gained Soviet permission to use a Douglas DC-9 on a six-city flight from Copenhagen to the Far East across the breadth of Russia.

The flight marked the first time an SAS aircraft has been permitted to fly beyond Europe. The airline originally was granted an "over-flight" only, allowing the airline to often only passengers to fly directly across Russia on its previous flights to the Far East Stop within Russia was made at Moscow and Tashkent.

The DC-9 was flown to Bangkok to replace a similar similar on lease to Thai Airways scheduled to return to Copenhagen for its after overflight period. The returning DC-9 flew over the round route to Rome and the Middle East.

## Landis Urges White House Office To Oversee U.S. Transport Policy

By Robert H. Cook

Washington—White House consultants and close supporters of national transportation policy for the guidance of a streamlined Civil Aviation Board and other agencies was recommended last week to President-elect John F. Kennedy.

Emphasizing the importance of the proposed office, Landis indicated its objectives, eliciting written support for:

- Ratification of government traffic rights, including the right to determine how to use the system of international air routes in the interests of national security and defense of the CAB and delegation of greater power to the Board's staff.
- Shortening the time required for the Board to consider applications for certificates of public convenience and necessity.
- Ratification of new charges for federal subsidies.
- Study of foreign air carrier competition.
- Negotiations of CAB's power in granting air carrier certificates, to include more emphasis on the surface carrying costs quality of service and the cost of a carrier rather than "more" customer support.
- Steps to facilitate the use of services in the principal factor in developing the maximization of transportation.

#### Other Reports

Kennedy ordered the Landis report immediately after he chose. Along with this report, he will have the results of a feasibility study of a new CAB proposal (AW Nov. 21, p. 57). He will also receive a critical report on the Board produced by the House Legislative Oversight Sub committee staff to consider any changes in the management of transportation plan for changes in the government's approach to air transport policy and regulation.

Landis would establish a vice White House executive office, called the Office for the Chair of Regulators. Again this. Under this proposal would come three subcommittees for transportation, communications and energy. This organization would encompass transportation, communications and energy. It also would oversee agencies under three cabinet of the President before this plan. The plan also would provide guidance for CAB.

Most of the new offices would be required to submit annual reports both to the President and Congress. Landis



ROYAL Air Maroc Concorde prepares for landing or takeoff at Toulouse, having stopped there en route from Paris flight.

## Air Maroc Bases Jet Service on One Plane

By Robert E. Fanch

**CASABLANCA,** Morocco—Rigorous jet maintenance system plus incentives to efficiency is permitting Royal Air Maroc, Morocco's state-controlled air carrier, to offer round-the-clock service on day and night flights Casablanca and Paris with a single Concorde.

Scheduling has been easy without a single flight cancellation since service began last May 20. Only delays, amounting to one hour, were due to arrival of Casablanca night post-preserved from Paris. Company's single Concorde will continue to be flown on night schedules until next Spring when the converted second Concorde III will be delivered and put into service.

By Dec. 1, Royal Air Maroc's single Concorde had logged 1,190 hr without a serious mechanical problem. Jean-Daniel Gervelle, director of operations, told *Airways*: "We're introducing the Concorde's first pre-hassos more trouble than metal bending of the company's four L-749 Constellations."

Delays over that seven-mile base of maintenance are needed for each Concorde flight alone. Thus it can have three of maintenance that the company has established for a single Concorde flight hour. Royal Air Maroc speaks three maintenance for each DC-1 flight hour.

### Carrier's Fleet

Company has four DC-10, four L-749 Constellations and the single Concorde. A second Concorde III is the only other jet in its stable of planes.

To keep its Concorde on a steady round-the-clock basis, the company had down the following operation and maintenance scheduling:

Based at its Casablanca headquarters, Royal Air Maroc's Concorde begins its

schedule on Wednesday. Flight 512 leaves Casablanca at 3:10 p.m., stops at Rabat, Morocco's capital, and then goes nonstop to Paris. The Concorde returns to Casablanca in 2 hr, 51 min. for more evening after flying over an hour and a half in Paris.

Some basic flight pattern is repeated during the next six days. On the Casablanca-Paris run, only one morning flight is made weekly. On the Paris-Casablanca weekly run, two morning flights are made. On other days, stops are made in Rabat, or Bordeaux or Toulouse. Also, on Thursday and Sunday, the Casablanca-Paris flight is extended to Frankfurt, returning the same day. In every case, the company's Concorde lands available in the morning and is back in the home city by nightfall.

On consecutive days of Concorde fly-throughs, two hours apart at 16 flight hours per day—leads when it lands at 3:30 p.m. Monday night at Casablanca. Company's Concorde service never flies but a day and a half—and Wednesday at 3:10 p.m.—to permit the aircraft for another six days of work. That is usually enough time to

schedule routine weekly inspection checks. Royal maintenance test comes about every 100 hr. work done on the aircraft's 300 hr inspection falls due. Royal Air Maroc handles all 300 hr inspections. When 200 hr. Concorde inspection comes—nearly twice yearly—that work will be done by Air France in Paris.

### Maintenance Routine

Shortly after the company's Concorde lands at Casablanca on Monday night for a 100 hr. inspection, a special preparation crew immediately prepares the aircraft for the type of inspection required. This work takes from 3-5 hr. Actual maintenance work goes underway. Two days later, inspection is completed, and the aircraft is ready for the next flight.

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schedule the repair for engine repair and preparation for the next flight schedule.

To date the company has kept to that schedule through the 200 hr. inspection. Some inspections require time-consuming labor, such as complete dis-



ONE of the carrier's two DC-10s is shown at Casablanca preparing for takeoff to Agadir, Morocco. Concorde tail in background is Royal Air Maroc flight to Africa.



CASABLANCA is shown landing passengers at Casablanca for Toulouse-Paris flight. It will return the same night.

assembly of cabin configuration. At times, more than a dozen safety gear are left over in the next week. In cases in which the aircraft is made available on Wednesday morning, Royal 200 hr. inspection falls due. Royal Air Maroc handles all 300 hr. inspections. When 200 hr. inspection, consisting 60 hr of work, is completed within 16 hr by 37 mechanics.

Company officials say that stability of the Concorde airplane and Royal Air Maroc mechanics have made their operation possible. The seventh two-Royal Air Maroc Concorde aircraft was recently delivered, raising the total to 11. Royal Overland is being done at Royal Rover in England. Rigging was at Kao racing conditions when removed, according to DuLoz. He claims more between overhauls could go to 2,000 hr. on the Concorde. Avions without Royal Reparation has recently been raised to 1,200 hr.

Royal Air Maroc has five Avion rigs, plus for the single Concorde, plus plane to hang aircraft, plus rigging and three for the two Concorde fleet.

Offices of the carrier appear to be well satisfied with those seven Concorde on the environment as well as the financial side. Concorde load factor of 75% is even somewhat higher than the number projected. System-wide load factor runs to about 80%, with a load factor of 65% on international routes.

Company operates its Concorde with 20 Att cabin crew (two on board and 18 in training) plus two flight engineers, consisting of two pilots and a flight engineer. Captain also handles the Concorde Concorde pilot is French. In fact, all the carrier's flight and cabin personnel—except for 12 Moroccan attendants—Europeans, mostly French. The company employs 26 pilots, 17 flight engineers, 12 cabin attendants and 23 hostesses.

Royal Air Maroc currently is operating a free-float fare structure.

• **First class.** Charged on Concorde flights and on two Constitutions flights to Casablanca and Toulouse.

- **Tourist class.** Charged on Concorde flights only. Both first and tourist Concorde fares are aligned on Air France Concorde service to Casablanca.
- **Economy class.** Charged on most of the company's Concorde flights, all of which are configured for 64 seats.
- **Economy class, night.** Charged on Constitutions night flights to Paris.
- **DC-10.** Charged on company's two DC-10 operating within Morocco and to Algiers ports.

### Fare Structure

The element of fare structure meets in special requirements, the company feels. Thus it isn't anxious to give IATA although it follows IATA rates as closely as possible on its intracontinental flights. These break down:

- **Concorde/Pars/Frankfurt.** This main trunk line was extended to Frankfurt last May with delivery of carrier's first Concorde. En route stops are Rabat, Casablanca and Toulouse. Both Concorde and Constitution equipment are used.
- **Concorde/Morocco.** Weekly Concorde trans flights with stops at Barbados and Rabat.
- **Concorde/Nouakchott.** En route stops are Rabat, Dakar, Nouakchott and Mauritania. Not all these Concorde flights are through services, some terminating at Mauritania and Nouakchott. A second Concorde will go on this route.

• **Algiers/Morocco.** Constitution and DC-10 flights linking Morocco cities with the cities of Oran and Algiers.

• **Concord/Dakar.** Weekly nonstop Constitution service.

• **Morocco-Spain.** Twice-weekly Constitution flights from Casablanca to Madrid. In addition to this main route, the company also operates short flights linking Morocco Mediterranean cities like Tangier with Gibraltar and Melilla, Spain.

All of Royal Air Maroc's routes to France, as well as its northern run to

Dakar, are operated under a pool agreement with Air France. Concorde also pools with the Spanish Iberia, Iberia and Avianca, on routes to Spain, and with Canadian Airlines on its Timor-Gibraltar run.

With exception of the Frankfurt addition last May, Royal Air Maroc has been operating its present international network for several years. Its main effort, however, has been to link Morocco with Africa, Asia and the Middle East. About 80% of the traffic handled by Royal Air Maroc is 15% foreign and only 15% Moroccan.

Initially the carrier's business has improved since the country's independence in 1956. Many Frenchmen while returning to France, undoubtedly caused by its vigorous business interests in the former French protectorate. Traffic is also seasonal, with summer vacation periods providing highest flight frequencies between Morocco and France.

Future needs plan of Royal Air Maroc include plans to expand traffic to Europe, specifically on the Paris-Morocco link.

Concord's entry to Milan is the only new route difference in the works for next year; the carrier is also studying routes to England, Bulgaria and Scandinavia. It is likely that the company will order a third Concorde if it decides to open that route.

Royal Air Maroc carried 114,161 passengers in 1991 and flew 15,500 commercial hours. This year company will introduce 110,000 passengers, 14,000 commercial hours. Gervelle adds, "In view of our 20% growth, Concord's market share has been increasing at an annual rate of 3-5% and company officials expect that rate to continue in the immediate future."

Royal Air Maroc traditionally has yielded profits for 15 years. For the year ending Sept. 30, company's profit was \$10,000,000. Gervelle officially expects the current year, ending June 30, will turn in a higher profit rate than will be the first full year of Concorde operation.

"Only down on the carrier's morning



AIRLINE OBSERVER

► British reports of future flight tests of an "ugly" wing on the Fairey FD.2 high-speed research aircraft have set off speculation that industry is trying to circumvent government limitations restricting supersonic transport work only to wind-tunnel testing. Ugly wing, currently housed by British Aircraft Corp. as the basis of design studies for a supersonic subsonic configuration, gets its name from the Sabah leading-edge of the wing.

**P**arking and liability insurance rates will not necessarily need to be revised upward by the TWA/United collision, but underwriters may still find the issue. Insua justify the high rates that compensated the jet operators and paid out claims against repair and reduction. However, if investigation leads underwriters to believe there is a fundamental problem at the root of the two crashes such as a deterioration of the New York traffic control system to handle the collisions were one of the circumstances allowed for in future rates. No single year's experience is used in setting insurance rates, so the collision alone would not necessarily be a determining factor in a rate change.

Sabena Belgian World Airlines has expressed interest in buying several Sikorsky S-92As, a twin-turboshaft helicopter capable of carrying 25 passengers (AW 10, p. 40). Cathay Pacific long-haul passenger traffic resulting from hostilities in the Congo have threatened the carrier's finances but outright purchase of the \$630,000 helicopters is not considered feasible. Sikorsky takes a dim view of leasing the S-92s, but hasn't ruled out such a program as a future possibility.

► Eastern Air Lines will spend about \$33 million this year on new ground facilities. Since \$16 million is slated for new jet hangars, turbine engine overholt plant and improvement of general facilities at Miami, Mandeville facilities, including new hangars at Boston, Atlanta and Norfolk, will account for \$13 million. Balance will cover costs of airport terminal improvements throughout system and are at refurbished ticket and service offices in 10 cities.

Special interest, participating towns of Koszeg (Young Communist League) activists have found that Adenauer's advertising messages aren't getting across to the public. Results of a poll taken by the group showed that more than 70 percent of the respondents said they had only a vague idea of the reforms allowed by the Social Contract. Investigators discovered that people at one Moscas station were taking the train to Berlin in certain S-Bahn sections where they were conscious of an "international" tone of advertising. Most train passengers had no idea of either form or the substance of changes that can be carried forward by us. Others thought that Adenauer was the last link and wished, and some even believed that basic reform requires at all Moscas stations.

► International Air Transport Assn. forecasts that a total of 118 million passengers will be carried by the world's domestic and international airlines in 1964. International Civil Aviation Organization has estimated that the world's airlines carried 108 million passengers in 1960, a 10% increase over the 55 million handled in 1955.

► Federal Aviation Agency has removed the 7,000 hr static life limit on the Fairchild PT-27's center wing section (AW Oct 24, p. 42), thus allowing local service carriers operating the twin turboprop to transport about 300,000 per year without an annual static check. Designated a "1st static" instead of a static life component by FAA, the center wing sections no longer need be scrapped at the 7,000 hr mark, but can be used indefinitely if periodically checked.

► Delta Air Lines has scrapped aerobatic overhead plans for the General Electric CJ-805 turboprop powerplants in its Convair 580 fleet due to the fact that the aircraft's maximum allowable gross weight of 16,000-lbs can no longer be exceeded as safely under Federal Aviation Authority's landing gear limit (ALM) Mar 9, 1970), which restricted overhead, at TBO levels near 1,800 hrs, would require an economic shutdown. The airline only reconsiders the aerobatic overhead concept proposed by GE when stage has determined the safe load at various points of the engine's components.

SHORTLINES

► Alaska Airlines is adopting a family fare plan, allowing customers of a family over 12 years of age to travel at two-thirds of the regular fare when one customer buys the full fare. The plan was scheduled to go into effect Jan. 8, and continues until April 30, subject to Civil Aviation Board review.

► Continental Airlines has asked Civil Aviation Board permission to cut its flight times up to 17½ hr one way during the daylight hours from Los Angeles to Chicago in order to encourage passengers to use the daytime turboprop flights between the two cities. Passengers would have to get dispensation to Continental's facilities or its carriage agent in Los Angeles between 2 a.m. and noon. Tickets would be scheduled on some of the airline's four turboprop flights to Chicago, which have a total of 60,000 hr capacity.

► Eastern Air Lines will add Sarasota/Bradenton, Fla., to its system June 15 as a result of the recent Civil Aeronautics Board decision in the Sarasota/Bradenton Service Investigation. Eastern will offer seven daily flights of the dual route segment.

► Northwest Airlines' deadline for voting service at Baltimore's Friendship International Airport, ordered by the Civil Aeronautics Board in the Washington Baltimore Air Quality of Service Investigation, has been extended to Feb. 28. The Board originally set the effective date of its order at Jan. 16. Northwest asked for a further stay to get its Convair 580s airborne on the route to Florida from Baltimore and obtain citizens' clearance at Friendship International Airport.

► North Central Airlines carried more than one million passengers in 1968, becoming the first local service airline to reach the million-passenger mark. Based in Minneapolis-St. Paul, North Central flight counts increased in 1968 by about 10% with the addition of 15 new Michigan cities. It serves 10 midwestern states with a present passenger volume of about 4,000.

► **Brazil Airlines** of Brazil has been awarded traffic rights from Rio de Janeiro to New York via Lima, Peru, by the Brazilian Ministry of Communications. The airline currently serves the U.S. at Miami and Los Angeles. Brazil plans to inaugurate budget service on all its international routes early in the summer using Convair 990 subjet transports scheduled for delivery in late



*Journal of Nonlinear Science* 2003, **13**, 63–88

## THE ENGINE WITH THE FUTURE

Reliability ... Efficiency ... Flexibility

At issue, these words have a million-dollar meaning. vast sums of money and vital scientific data ride on these basic attributes of Bell Aerospace's rocket engine for Lockheed's Agena satellite, second stage of the *Ariane* Discovery series.

The Agema engine, designed with space in mind long before space became a household word, has fulfilled its every mission and has placed more tons of useful payload into orbit than any other power plant. Its operational reliability is based on ten years of development and 5,000 test firings.

This Bell engine now has re-start capability — the first in the nation. This means that in orbit we can change orbit in space without the penalty of extra engines. Presently in production, this engine also is adjustable to new fuels and new assignments and, consequently, programmable for important military and peaceful space programs of the future.

Agena's success is typical of the exciting projects at Bell's rocket propulsion center. It is part of the dynamic new approach of a company that's forging ahead in rocketry, avionics and space techniques. These skills serve all government agencies. Engineers and scientists anxious for a new kind of personal challenge can find it at Bell.



**BELL AEROSYSTEMS COMPANY**  
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# Airline Income & Expenses—October, 1960

(IN MILLIONS)

	Passenger Revenue	U. S. Mail	Express	Freight	Charter	Total Operating Expenditure	Net Operating Income	Net Income Before Taxes
<b>DOMESTIC, 1960*</b>								
American	16,357,300	107,360	945,540	8,841,180	115,100	28,190,000	35,101,390	3,101,390
Braniff	1,017,200	102,200	94,320	1,042,320	115,100	4,742,260	5,161,370	461,370
Continental	8,332,110	100,200	101,147	1,070,320	100,000	26,700,000	30,700,000	—
Eastern	3,398,200	11,200	40,000	130,000	11,000	8,405,000	6,795,000	495,000
Delta	10,457,000	100,000	100,000	100,000	100,000	27,360,000	11,264,000	705,000
Frontier	1,171,100	1,171,100	1,171,100	1,171,100	1,171,100	11,171,100	11,171,100	1,171,100
Midwest	2,187,320	82,240	20,744	192,372	211,272	14,187,320	1,000,000	1,000,000
Northeast	2,104,980	48,390	26,050	70,370	70,370	5,812,890	9,481,410	—
Northwest	5,385,020	85,190	10,243	14,000	11,000	11,000	7,822,360	8,022,410
Southwest	2,112,100	100,000	100,000	100,000	100,000	10,000	7,000	7,000
United	21,273,310	1,052,260	2,207,074	431,150	35,040,000	35,040,000	2,995,340	2,995,340
Western	4,793,080	811,100	106,730	65,100	65,100	5,472,390	415,390	415,390
<b>INTERNATIONAL</b>								
American	100,860	4,070	1,360	42,462	42,462	420,810	390,810	—
British	100,450	94,000	46,075	46,075	46,075	325,720	197,000	—
Canadian Airlines	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
Egypt	132,000	2,000	8,300	8,300	8,300	132,000	132,000	132,000
Eastern	1,147,100	60,000	111,000	111,000	111,000	3,236,000	1,146,000	—
Mexico	75,000	1,000	2,000	2,000	2,000	75,000	75,000	75,000
Midwest	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Northeast	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
United	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Western	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Pan American Continental	24,444,000	1,100,000	4,000,000	1,100,000	1,100,000	24,444,000	24,444,000	—
Africa	115,200	12,000	48,200	48,200	48,200	144,000	44,000	44,000
Asia	12,000	1,000	1,000	1,000	1,000	12,000	12,000	12,000
Latin America	2,400,000	200,000	300,000	300,000	300,000	2,400,000	1,100,000	1,100,000
Pacific	2,341,000	1,000,000	1,100,000	1,100,000	1,100,000	10,000,000	10,000,000	10,000,000
Scandinavia	1,713,200	30,000	30,000	30,000	30,000	3,000,000	3,000,000	3,000,000
Europe	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Trans-Caribbean	400,450	21,100	21,100	21,100	21,100	21,100	21,100	21,100
Venezuela	6,028,040	715,200	405,200	405,200	405,200	8,028,040	7,746,000	7,746,000
Other	2,000	400	400	400	400	2,000	1,600	1,600
Wales	300,200	3,100	3,100	3,100	3,100	3,100	217,700	217,700
<b>EUROPE</b>								
Aer Lingus	1,000,000	10,000	21,120	33,420	33,420	1,200,000	1,000,000	—
Brussels	450,300	3,100	4,100	5,400	5,400	6,500	2,700	2,700
Central	1,000,000	10,000	5,000	10,000	10,000	10,000	10,000	10,000
Finland	200,000	10,000	4,000	4,000	4,000	1,100,000	1,100,000	400,000
Iberia-Cortefiel	200,100	10,000	4,000	4,000	4,000	1,100,000	1,100,000	400,000
Iceland	100,000	10,000	10,000	10,000	10,000	100,000	100,000	100,000
Malta	100,000	10,000	10,000	10,000	10,000	100,000	100,000	100,000
North Central	1,100,000	80,000	80,000	80,000	80,000	1,200,000	1,200,000	1,200,000
Other	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Portugal	100,000	10,000	8,000	8,000	8,000	100,000	100,000	100,000
Scandinavia	1,000,000	10,000	10,000	10,000	10,000	1,200,000	1,200,000	1,200,000
Spain	100,000	10,000	10,000	10,000	10,000	100,000	100,000	100,000
Switzerland	100,000	10,000	10,000	10,000	10,000	100,000	100,000	100,000
Turkey	100,000	10,000	10,000	10,000	10,000	100,000	100,000	100,000
West Coast	100,000	10,000	10,000	10,000	10,000	100,000	100,000	100,000
<b>ASIA</b>								
Air Asia	280,180	2,000	1,000	1,000	1,000	4,000	2,700	2,700
Malaysia	300,000	2,000	1,000	1,000	1,000	4,000	3,000	3,000
<b>CANADA</b>								
AA/CSA	1,000,000	10,000	10,000	10,000	10,000	1,200,000	1,000,000	—
Canadian Air Lines	1,000,000	10,000	10,000	10,000	10,000	1,200,000	1,000,000	—
Flights	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Government	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Montreal	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Quebec	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
St. John's	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
<b>MIDDLE EAST</b>								
Arabia-Halafah	177,740	100,000	10,000	10,000	10,000	200,000	100,000	100,000
Lebanon-Airways	1,000	100	100	100	100	1,000	100	100
New-York-Airways	177,740	100,000	10,000	10,000	10,000	200,000	100,000	100,000
<b>AFRICA</b>								
Afrikana	200,000	10,000	1,000	1,000	1,000	200,000	100,000	100,000
Afrikana-Centraal	70,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Conair	17,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
EEA	44,000	2,000	1,000	1,000	1,000	100,000	100,000	100,000
Maritime-Centraal	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Petrolia	300,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Petrolia-Nethants	300,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Petrolia-Sud-Afric	300,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Petrolia-Africa	300,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Petrolia-Africa-Amerika	300,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
West Africa	300,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
<b>ASIA AIRLINES</b>								
Air India	200,000	10,000	1,000	1,000	1,000	200,000	100,000	100,000
Air India-Central	70,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Calcutta	17,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
EEA	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Hong Kong	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Indonesia	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Malaya	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Philippines	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Singapore	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Thailand	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Tokyo	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
Yakarta	10,000	10,000	1,000	1,000	1,000	100,000	100,000	100,000
<b>ASIA AIRLINES-International</b>								
Not available								
4 routes supported								
New Oct 21								
<b>ASIA AIRLINES-International Transportation</b>								
Non-intertropical transportation or other transportation								
After divisional operations								
Int'l. Divisional resources								
Compiled by Aviation Week from airline reports in the Civil Aviation Authority Board								



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## NEW VICKERS VANGUARD NOW IN AMERICAN SKIES

Take a good long look at this airplane. The Vickers Vanguard is absolutely new to you, but you'll see it in the sky... now over Canada and next May over the United States. The Vanguard was checked-out in England all summer and fall and the first plane was delivered to Trans-Canada Air Lines in Montreal on December 8th and the second on December 12th. Girt used to be named VAM-DUA-BD. This plane is making history in Canada and in Europe for British European Airways because it passes the jets at less than half the cost. The builders... Vickers and Rolls-Royce... are the most

successful jet-prop team in the industry. If you doubt it... look at the record of the famous Vickers Viscount: 2 million flights • 65 million passengers • 3 million hours in the air • 880 million miles flown. Every 24 seconds a Vickers-Rolls Royce turbo-prop plane is taking off or landing somewhere in the world. This unparalleled experience is behind the new Vanguard. Look for it... travel on it... the newest turbo-prop in North America. For further details contact: Christopher Clerkson, U.S. Representative, 13 Rockefeller Plaza, New York 20, N.Y.

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## Anti-Radiation Shielding May Be Reduced

By Ernest J. Bellon

**Barksdale AFB, Tex.**—Use of heavy anti-radiation shielding may not be necessary for protection of astronauts, at least for trips of short duration. In a recent study of human tissue and other materials which orbited the earth aboard the Discoverer XVII satellite, Dr. Lester Jacobs

Medical researchers who have an interest believe the specimens have at USAF's Aerospace Medical Center, which prepared them for flight, go a step further in their conclusions. They indicate, in fact, that lesser shielding may be sufficient.

They are to submit a report (shortened) and let the military through the command's board, then to have the pertinent authorities sign on the basis and/or have the astronauts receive a signal cast down from secondary radiation protection. Dr. George W. Crawford, nuclear physicist at the School of Aviation Medicine's Department of Radio biology, stated:

Some portions of the data files on the first two specimens prepared by researchers here were in space during one of the longest solar flares ever recorded and were exposed to the radiation of this flare for 50 hr, starting 7 hr after the flare began. This was the first time that specimens from this country were exposed to a solar flare of this magnitude for such an extended time period and survived for detailed laboratory analysis.

Some specimens were exposed to different types of metals to test their effectiveness as shielding materials, while other specimens were shielded only in the thin aluminum covering of the specimen capsule mounted on the Discoverer satellite.

Another indicates that the specimens protected by the aluminum took a lower dose than those with full shielding according to Dr. Crawford. He pointed out that heavy metals such as gold or lead become a hazard during a solar flare as high energy protons interact with these heavy materials to cause damaging X-rays. "This does not offend with the lighting rods or planes," he said.

Specimens contained in the 3.56-diameter capsule on Discoverer XVII included:

\* Living human cells that had originated from the normal lining of a bone joint and from the connective tissue of the eye were grown artificially

in a special chamber. On the 12th day after preparation the cultures were submitted to the satellite and were returned to the USAF laboratory here on the 16th day after exposure. Previous studies indicated that these cultures showed an advanced state of degeneration but on the 12th day after orbital exposure had a normal appearance.

The 20th day after arrival, these were definitely growing in the flight culture cells were undergoing multiplication and were normal again. It is believed that the initial poor appearance of the specimens was high due to oxidation of the special artificial medium in the living bone tissue. After removal of the special artificial medium in the living bone tissue the cultures before they were returned to the laboratory and received all the protection normal of space cells to

### Electronic Spin Chair

**Barksdale AFB**—The electronic spin chair designed to provide USAF aerospace medical studies with enhanced data on the nature of the human response to weightlessness will be completed later at the Air Force School of Aviation Medicine.

The apparatus consists of a padded adjustable chair in which the subject can recline on a vertical axis. It is powered by an electric-hydraulic system and will be controlled by an electronic computer. The spin chair will be used on the ground to determine the effects of weightlessness on man. In addition, the chair will be used to study the effects of weightlessness on the heart and the skin pass through the desired positions with decreased intensity and duration of several times each position controlled.

The armchair will be used in long range satellite research programs to study the effects of physical stimuli on the human heart rate, or respiration, which normally are regular, that would when the body is tilted in a horizontal position, give false signals which can lead to a pilot flying on mental strength.

Spacecraft cannot sit more than 30-35 RAD during the 50 hr they are in space. Eight different types of domes were used and the whole body radiation dose measured while the capsule was surrounded by four solid walls.

Spacecraft engineers also indicated:

- \* No electrons entered the electronics compartment because there was no electron exposure in the atmosphere space can really protect a person against the sun's ionosphere and that separated photo cells are required in the other Van Allen zone to this problem.

Radiation alone cannot be held responsible for the cellular damage and death that did occur, laboratory tests cannot point out.

\* Radiation instances from human and animal bloods were experimentally placed on absorbent paper and parked with a radioactive material to render them into. Postflight observations of the radioactive material in damaged connective tissue bombardment so that differences were detected between exposed and non-exposed blood samples prepared 30-32 days previously. Such a report.

\* Bacterial spores, of the species that could survive even conditions of extreme exposure to seek, were sealed on glass vials for the flight. These heat-resistant spores, upon return to the laboratory, were put into a test tube containing a very hot solution of sterilized sugar. Spores that had been dropped to Vandenberg AFB, Calif., but had not been on the satellite, also were sterilized and served as a control sample. At a certain temperature all the control cells were killed rapidly by the solution. In contrast, most of the spores returned from space survived their postflight treatment in the solution. This result appears to bear out studies recently carried out by the School of Aviation Medicine, which shows that radiation acts to reduce the killing action of certain antibiotics on bacterial suspensions. The spore data on the other hand, suggests that this particular species may be useful as a biological index of the space radiation hazard. Major David S. Scott, Aerospaceobiology Section and Thomas Roberts, microbiologist, suggested.

\* A gear control shift in the Discoverer XVII experiment, indicated that they are able to exist in a frictional rather than a rolling wheel under zero gravity environment. Looking up under findings that had been developed with cyclohexane experiments under simulated conditions, according to Dr. J. Neal Phillips, Jr., space ecology specialist.

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Pre-Launch View of Discoverer XVII

Discoverer XVII is shown poised on launching pad at Vandenberg AFB, Calif., prior to successful firing with a modified Douglas D-558-2 Thor booster. It is easier than Thor boosters used to launch Agave A Discoverers (AVN Nov. 21, p. 35).

After half the gear passed through the holes of the half fire hoses or rails of the 32 cables.

\* No transistors from electrons being stopped in the walls of the can were observed.

\* No neutrons were detected by either of two independent measurements.

\* A total of about 10 hr in the earth's protective field made this per space exposure was estimated from a study of four flights.

\* There observational array of dosimeters failed to detect any dosimeter effect and the radiation dose did not show uniform through the can except where lead had been used as part of the stop plane shielding experiments.

\* In the localized regions where lead or other materials were placed, X rays were measured. Both photo transistors required greater doses energies above 1 billion electron volts. This use of lead, gold or other heavy metals for

shielding of proton beam笔直的射线 not produce an light metal such as aluminum, as a plastic material.

\* Total proton flux was about 6 x 10<sup>-10</sup> to the eighth power proton per square centimeter.

### Navy Space Program Gets Budget Increase

Washington—Navy astronauts program is slated to get its first substantial financial support with the \$11 million allocated for it in fiscal 1962, and it will be aimed at using new atomic annihilation techniques to produce much cheaper satellites for operation at orbits up to 100 mi.

Joining with under \$1 million for the year, the astronauts program will support a variety of studies aimed at capitalizing on atomic component

annihilation techniques, break-throughs to orbit satellite use and costs. Although defense requirements have not yet been generated as of yet, the Navy has decided at each acquisition, one transmission and weather satellites to support first operations.

Navy wants to put several dozen 100-100 lb satellites a year into low orbits, and that would be launched at any rate with the Sea Scout. This four-stage rocket, developed by the Polaris missile company, plus the two upper stages of the six-stage Blue Scout solid-fuel launch vehicle. It would put 150 lb in a 100 mi. orbit.

Sea Scout could be launched from a ship like the USS Observation Island, which has been used in Polaris missile test flights. Navy points out that the feasibility of sea launching could make the Sea Scout valuable for communications satellite orbits, enabling the agency to obtain world clientele through the use of building display capability at the vehicle production stage.

In the field of atmospheric reentry, the Navy believes it has a feasible low cost solution. Project Skaper, which consists a vertical probe, or space cone, which would place a cloud of small shot in the path of a satellite. These shot will penetrate the reentry vehicle's heat shield and slow it down enough until it is in the cloud of shot. Navy contends this approach would eliminate any need for complex reentry systems for multistage work.

\* Navy communications satellite would supplement and complement Army and National Aerospace and Space Administration programs. In addition it would go to join Project Loon, which is aimed at determining the propagation and communications characteristics of very low frequency communications waves in the stratosphere and beyond the troposphere. At present, Loon packages as planned for piggyback, radio or basic Transat orbits will suffice alone.

For reentrywork, Navy's Project Yucca involves a single gas satellite which would accomplish its mission in six fast trips, shortening the hours of earth tracking and decreasing it. A two-stage solid-rocket booster known and used by the Radio Corporation of America would be installed to allow satellite conditions in remote areas for coordination with the first three dual-stage satelites.

The most severe current Navy space program is the Transit navigation satellite, which is funded separately from the astronauts program. By needs, development, test and evaluation cost plan of the Transit program is \$17 million for fiscal 1962, and another \$15 million is allotted for the operational phase.

# British Scout Satellite in Development

By John Tunnell

**L**ONDON—Construction and testing of prototype equipment for the British experimental Scout satellite is now under way following lengthy agreement between the British National Committee on Space Research and National Aeronautics and Space Administration in Washington on the suitability and pertinence of the proposed experimental program.

According to an Associated Press service, new techniques and scientific equipment has been developed in the U.K. for the British program which will permit the encounter with studies of electron temperatures and densities, ion energy distribution and mass spectrum in the ionosphere.

The program will also include a major study of the cause of energy spectrum of a type which has not been previously attempted.

## Distinguishing Feature

One of the main distinguishing features of the British instrumentation is the provision of differentiating means within the satellite to help for the first time—which enable the probe current voltage ratios to be analyzed and as direct before telecasting. Notable detail of the current ratio measurements comes on the use of a particle counter during the Cherenkov-light counter effect.

Prof. P. E. J. Sorenson who leads one of the three participating universities in the project said: "The satellite will not be going anywhere now and much of the

complex results will be largely on board."

The satellite, S-51, will be a cylinder 60 feet in diameter with four spherical ends. Instrument load will weigh about 20 lb. and the weight of the satellite structure, batteries, and solar power supply, all of which will be supplied by the United States, totals 100 lb.

The tape recorder in the satellite will record ground commands, the nature of which will be learned at the U.K. radio research station at Slough.

Launching of the Scout four-stage rocket is expected from Wallops Island, Va., within the next 12 months.

The selection of the groups has been confined to those stations who have had extensive experience in ionospheric measurements with Maserbeams and in the plasma physics field. The University of Birmingham has recently been involved in a satellite. The instrument consists of a 10-mm. plasma and a photoionometer. Heavy particles moving with speeds approaching that of light pass through the plasma at speeds so slow of the speed of light in the material. In the process of slowing down in the plasma, energy release in the form of light emission occurs—the Cherenkov effect.

The light is emitted within the sphere and projected to the photomultiplier tube.

Studies on the heavy particles are much more powerful than those entered by the smaller particles and the currents may be gauged that only the heavy particles will be counted.

This ability to discriminate in favor of the heavy particles is the main advantage of the detector over more conventional instruments such as the Geiger-Muller. Sorenson has tended to conduct previous measurements and Elstot because the denser the particle, the bigger the pulse. "The Cherenkov detector is blind to the ionized ranks."

Besides no equipment like the detector has yet flown it is intended to test the design in a Black Knight flying laboratory in connection with a satellite.

Long-term experiments at the University College group are the relation of the changes in the plasma spectrum to the changes in the strength and configuration of the ionospheric magnetic field.

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based that large measurements of the ratio of the plasma spectrum can be deduced from aircraft measurements alone.

The plasma spectrum—which is the number of particles of a given velocity—can be found by observing the plasma spectrum variations with latitude; these variations being due to the effects of the earth's magnetic field. Only the magnetic field vector can get through near the earth. By measuring the variation in current different latitudes the number of particles in a particular energy band will be deduced.

## Cherenkov Detector

Prof. Elstot told *Aerospace Week* that the group has developed a "periodically flat" of looking at the heavy ion current particle beyond action. It is based on a Cherenkov detector and can measure 100,000 electrons per second. It has recently been used in a satellite. The instrument consists of a 10-mm. plasma and a photoionometer. Heavy particles moving with speeds approaching that of light pass through the plasma at speeds so slow of the speed of light in the material. In the process of slowing down in the plasma, energy release in the form of light emission occurs—the Cherenkov effect.

The light is emitted within the sphere and projected to the photomultiplier tube.

Studies on the heavy particles are much more powerful than those entered by the smaller particles and the currents may be gauged that only the heavy particles will be counted.

This ability to discriminate in favor of the heavy particles is the main advantage of the detector over more conventional instruments such as the Geiger-Muller. Sorenson has tended to conduct previous measurements and Elstot because the denser the particle, the bigger the pulse. "The Cherenkov detector is blind to the ionized ranks."

Besides no equipment like the detector has yet flown it is intended to test the design in a Black Knight flying laboratory in connection with a satellite.

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separation" set of experiments. The results will be correlated.

Another group of experiments by University College aims to measure both the ion current spectrum and the ion wave spectrum.

At the time Prof. Sorenson left the University College to look at the alternative ionization sources for the sun in order to correlate influences from the sun with the properties of the ionosphere.

The method of studying the local free electron population density in space adopted by the Birmingham group does not depend on conventional laboratory probe techniques, but on the charge or dielectric constant which the particles produce in the medium within which they move.

The method of electron density measurement was pioneered by Birmingham University and first proved at Skyeboe from Whetstone some years ago. Although the U.S. has now taken up the method, Sorenson said the actual intent to be employed in the Scout satellite is a far more accurate development of the original system. Sorenson wouldn't say that the group had succeeded in final, but he said, "We have been doing it longer, and we have more experience of the method."

## Density Measurement

Briefly, in response to his question, the effects of the plasma between the plates as a dielectric being proportional to electron density. To obtain a sole value, either the ionosphere behavior and interplanetary, the plates of the capacitor will be "recalibrated" of electrons every few seconds by biasing the electron source and the reading system interlocked, normally.

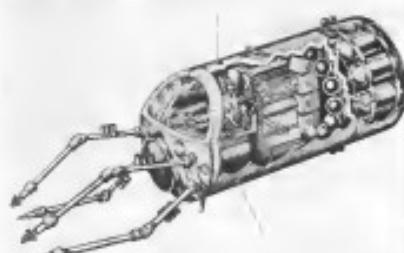
The apparatus consists of two tuning electrodes of a few square inches each placed a few inches apart and connected to a radio frequency source of 10 mc.

Under the influence of the alternating field associated with the plates the electron current between the plates is measured. The ratio of the currents is a function of the charge of particles. When the electric field strength induces small oscillations (inductance) cannot be flux to the electrodes.

The alternating induced current is amplified electronically, within the unit itself and represented as a dc voltage which is proportional to the electron density.

Several factors determine the frequency of the current source, Sorenson explained. The ratios of rates of change between the frequency and the rate of the rotated radio wave propagation frequency. This is also related to ionization probability.

The ionosphere also affects the ratio of the induced current to the normal current flowing in the electrodes. At 10 mc, the induced current flow is of the



## Martin Studies SLOMAR Space Vehicle Designs

In Florida, Wright Air Development Division has prepared early-binding Model 008 for study the need and design for a space logistics maintenance and control (SLOMAR) station which would service spacecraft in the next 15 years. Martin Douglas and Norris will make for study under SA 040080 contract Lockheed and Convair have 199,000 nearly and General Electric's contract is submitted. Basic concepts are shown. Shuttle vehicle would carry for use or cargo payload to rendezvous with orbiting space station that glide to earth. Martin's return space rig below would be used in assembly a space station in orbit. The concepts were selected for SLOMAR study several months ago. VW Oct. 24 p. 21 and negotiations were completed in mid-November. Program studies include orbital mechanics, communication subsystems, navigation and radio systems, vehicle location and location of space payload module interfaces, techniques for maneuvering, subsystems and studies of various operational procedures. The required for a study of pilot escape during boost and reentry. Studies will consider use of nuclear propulsion for upper stage and auxiliary power.

The capacitance technique appears to be slightly heavier and more complicated, but at both will be simplified by use of a single probe with the two capacitors in orbit ultimately decide the most suitable approach.

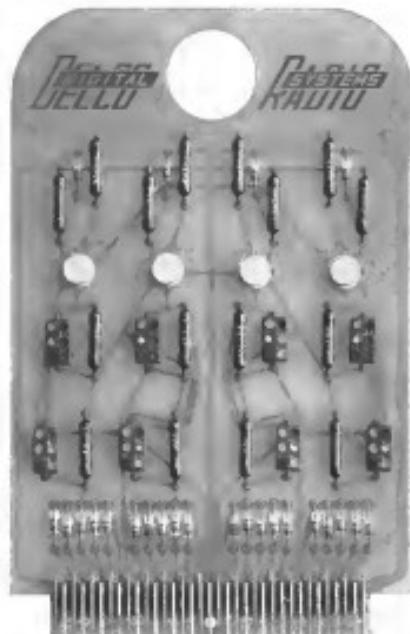
Validity of the capacitance method has already been proved in a Black Knight flight in which the core zone acted as one probe and the rest of the rocket as the other.

The electrode beam of the capacitance equipment is retracted during



Second Saturn Booster Assembly Fixture

Second Saturn booster assembly fixture must complete the test at the Marshall Space Flight Center, as the first Saturn rocket to be light tested entered its final stages of assembly. Booster supporting and rotating the booster during assembly operations, the dual purpose fixture is equipped with mounting pins to serve as the rocket's transportation fixture.



## DIGITAL MODULES

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launching. As fired in the Skylab under the control of measurement electronics, each probe is 14 D. with hot tips. Scattered in the equipment will enable electron densities down to a few thousand per cubic centimeter to be measured and is therefore suitable for studies of high density orbits or in earth probes.

The University College group will use highly developed forms of the Langmuir probe technique in its ionospheric measurements. These are currently used in the college's physics department for plasma investigations in discharge tubes. Using couples and potential electrode methods, the technique enables the examination of heavy negative ions in the probe current to be distinguished from that of much lighter electrons, in the probe current-voltage curve.

The equipment will be used to determine electron temperatures and the same technique will be used on an analysis of the ion energy spectrum.

The determination of the ion mass spectrum by this technique is based on the fact that the current with which an ion impacts a cathode is approximately half the product of the ion mass and the voltage of the cathode squared.

### Radiation Measurement

Another major experiment of this group will be the monitoring of the fluxes of Lyman Alpha radiation and soft X rays, using equipments which have already been used in the Skylab flights.

By Ward emphasized the chain-gathering features of the ion mass and ion electron temperature measuring equipment in Skylab to be the additional ability of the probe current voltage curves to give the particle and atomic ion and alpha differential techniques, which was not time dependent.

Using the second Langmuir probe technique, electron temperature is derived directly from the ratio of the first and second derivatives of the 0.01 eV current voltage curve of the probe electrode. Previous workers have attempted to measure the ratio of the second derivative to the first derivative of the ion current voltage curve from the voltage of the probe electrode. This is not possible, Ward says, due to the noise signal when  $\frac{d^2}{dx^2}$  is affected by variations in the vehicle potential which tend to swamp the effect it is desired to measure.

Ward's modification of the Langmuir probe technique enables the EV probe current to be analyzed on board, and its second derivative which contains much of the energy information telecentered directly to Earth.

The computing technique which has been widely used is based on the fact that if two voltages of different



**Device Proposed to Orient Satellite**

Satellite-oriented device proposed by Convair Astronautics design specialist Lawrence J. Koen consists of a 100-ft. parabolic tube which would focus sunlight, top, and four short narrow-beam mirrors which would reflect the focused beam to a central detector unit, glass fiber, biconvex or biconcave, in order to get increased intensity when reflected by electric mirrors. Design is based on theory that probe emits a stronger glow on the end of a satellite about a planet, while retarding force keeps opposite end of elongated satellite pointed away from the planet.

frequency are applied to the probe, thus, giving a modulated wave, the degree of modulation being proportional to the second derivative of the EV signal. The finding from the fact that if the modulated wave is passed through an amplifier with sufficient volume control, the rate takes the ratio of the first and second derivatives.

The first derivative gives the amplitude of the main wave and the second derivative gives the modulation. Since the ratio is proportional to the percentage depth of the modulation, and hence to electron temperature.

The ion energy spectrum is one which the same pertains to the above analysis as a second spherical probe EV curve, a second spherical probe EV curve, the probe being located on the spin axis of the vehicle. The energy

spectrum is contained in the value of the second derivative, the size of the two derivatives again being proportional to the ion mass.

Plotting the ratio of the second derivative against voltage gives the ion energy spectrum. Because the vehicle has hyperbolic velocities, parallel to one of the outer radii random speed of the ions it follows that the energy energy (with due correction for satellite charge) is approximately half the product of the ion mass and the satellite velocity and so the mass spectrum can be deduced directly from the energy spectrum.

As the computation method does not involve differentiation with respect to time it avoids the introduction of complications due to other time dependent parameters such as the vehicle motion

## Discoverer XIX Gathering Midas Data

Los Angeles—Discoverer XIX, satellite number 109, will be flight tested from Vandenberg AFB on Dec. 28. No scientific objectives but primarily gathering data for the Midas early warning program.

The satellite carries infrared equipment similar to that planned for Midas satellites. Unlike earlier flights in the Discoverer program, there will be no effort to measure a data capsule. Instead the 2,100-lb. Agae-8 spectrometer will be telecommanded to generate test data several times a day during the two-month orbital life. The instrument aboard the satellite will measure the total background infrared emitted and reflected from the earth and its atmosphere. The experiment was planned to continue until the batman about the 25th, long Agae-8 expected about four days after launch.

Period of the Discoverer XIX orbit is 91 min. Its range is about 600 mi. and its perigee is 210 mi. The satellite will be located at the end of Vandenberg AFB's 3-ft. Magenta Rocket Launch Pad 30, 3½ miles North of Santa Barbara, Calif., where USAF has leased the space to Lockheed. Technical readout will be provided by these stations and the Western ship USMSB Redfield located downrange from Vandenberg.

Agae-8 and initial commands to the Agae-8 propagation system will be transmitted from the Pt. Mugu station. All tracking and telemetry data will be transmitted from the Agae-8 system to the USAF Satellite Test Control Station, orifice, Calif., where USAF has leased the Discoverer program to build the technical and management skills that will be needed by military units launching and operating Midas and Samos satellite systems.

Ford developmental models of Midas and Samos will be launched from naval mobile facilities at Pt. Arguello, the Redfield site, and Redfield, respectively, south of Vandenberg. The first two of Midas vehicles will be planned to enable USAF to observe all the earth with about 10 satellites in polar orbits.

## Plum Brook Reactor To Operate in March

Washington—Nuclear fuel will be loaded into the Plum Brook reactor in mid-March at the National Aeronautics and Space Administration's laboratory in Ohio. The program to develop non-nuclear components for nuclear space propulsion systems

Aerospace Energy Commission funding based granted NASA a permanent permit to operate the 60-kw., water-cooled

test reactor after hearings completed Dec. 16 and physicists now are preparing to begin relatively tests within 90 days.

In developments associated with operation of the reactor, NASA's Lewis Research Center recently awarded a contract to a composite molding contractor to fabricate a reactor heat shield next year for a composite heat-shielding device.

Liquidated Arnold's Composite Division has a \$494,000 contract to build a composite matrix which will be used to mold the central rods and check out metal feasibility of potential nuclear reactor components. The liquidated reactor will be used to measure neutron and gamma properties and neutron effects of components before they are exposed to the environment of the 60 kw. reactor.

Research for preprogram has been moved far an accelerated propagation program to insure experiments in exposure paths in the reactor so that performance characteristics can be measured. Beds for the reactor, consisting of propellant tanks, drive and guidance system and power supply, are due at Lewis Jan. 24.

Testing comparable to that tested in the Plumb Brook facility are structural materials, pumps, seals, shielding, auxiliary power gear and working fluids.

## Military Supply Center Uses Computer System

Washington—New data processing center which performs the role of the world's largest shipping and bill of lading computer for the Armed Forces Supply Support Center (AFSSC).

The new AFSSC facility will keep a running up-to-the-minute inventory of more than 7½ million items used in armed services which will be stored on 216 rolls of magnetic tape. The new equipment, which can handle 100,000 individual shipping items at a time, is being installed at Intertel International Business Machines Corp. IBM 705 IBM large scale computer and three smaller IBM 1401 systems, one of which is now installed. Other two are slated for operation by next July.

Since all the management support services which the new system can provide quickly upon request include:

- List of users, location and amount of excess inventory of and at every item listed in the federal catalog. This will be done in increments of highest, intermediate and lowest quantity items in a stable supplier.
- List of data to manufacture part number giving corresponding federal stock number. This is expected to be periodically modified in permitting spare parts for new weapon systems and

components which are standard parts already in the inventory for other weapons or equipments. Results indicate evidence that up to 30% of new weapon parts already exist in the fed stock inventory.

The new AFSSC data processing system began its operational development period in December 1966. The initial system, which is purchased each providing identification data for about 60% of the items in the inventory, disclosed scalar composite requirements in two-months and coded data required to handle inquiries to more than half the agency's 6000 employees.

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The new AFSSC system is expected to handle the present work load in a 16 hr. day, 5-day week period, providing surplus time for providing new management control data.

The AFSSC facility serves 90 government facilities, agencies, including the Atomic Energy Commission, National Oceanic and Atmospheric Administration, Central Security Administration and National Security Agency, in addition to the military services. The AFSSC facility is limited to 35 core administrative centers. In terms of operational data, the data transmission equipment which enables the system to communicate directly with the intermediate IBM 360/370 computers. The 360/370 system checks incoming quantity and data for validity, and storage times are a fraction of that can be used by the larger IBM 705 IBM.

## System Designed to Purify Air Inside Space Capsule

Hanover Standard has ushered into use a 100-ft. test of a system designed to remove impurities from the air inside capsules for 24 years.

The test, under development for 2½ years, provides for through cleaning that contains fine particles, crystals of sodium alumina silicate. These crystals have pores 15 to 20 billionths of an inch in diameter which absorb the odors of cigarette smoke.

In the recent tests, two capsules were closed made an airtight chamber and carbon dioxide was fed into the chamber to simulate the respiration output of a man breathing regular air. The CO<sub>2</sub> collected in the chamber was extracted by a vacuum pump which simulated the respiration of a man. In this test more than 100 cu ft of carbon dioxide, weighing about 36 lb., were extracted during the 100-hr. test.



Model of a complete mobile unit support base (MUSB), part of which is shown above, was made by Boeing Airplane Co. for a recent developmental engineering inspection held in Seattle. Wind, Service, maintenance and supply will be performed here on the Minuteman missile train between the two ends "trains" they will make over the nation's 180,000 mi. of missile. First MUSB will be constructed near Keesler AFB, Miss.

## Minuteman Mobile Unit Support Base Model Shown

Another model car of the mobile Minuteman unit is equipped with two identical launch canisters in series, shown here in the developmental engineering inspection (DEI) model. Canister base fire positions for each of the missiles carried in the train. Canisters will be separated by bellows, plus, and will be raised through separate, locking doors. Separation on both canisters must be completed before a missile can be fired, thereby preventing inadvertent firing by one can.

Mobile transfer building shown below is model form, will be built to accommodate outside carriers in the mobile unit support base (MUSB). Here Minuteman missiles will be placed within strengtheners, under warheads will be installed, and the resultant ICBDMs will be loaded aboard rail cars.





# AMERICA'S ASTRONAUTS WILL BE LAUNCHED INTO SPACE BY ROCKETDYNE ENGINES

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The most proven large ballistic missiles—the Atlas, Delta, and Redstone engines—will launch America's Astronauts. Many of the engines of both are by Rocketdyne.

## AERONAUTICAL ENGINEERING



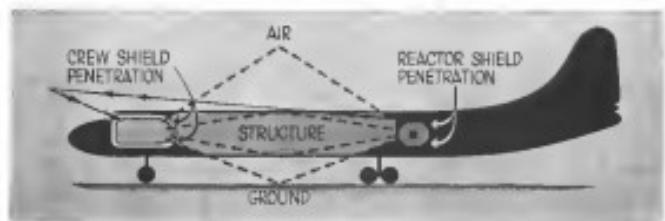
**NUCLEAR-POWERED** attack aircraft envisioned by the Air Force in 1955 is shown above. This Lockheed design was to have been powered by six Pratt & Whitney nuclear-cycle (X-15) nuclear turbojet engines operating from two circulating fuel reactors. The aircraft would have had impressive dash capability when nuclear power was augmented by burning chemical fuel.

### *Special Report:*

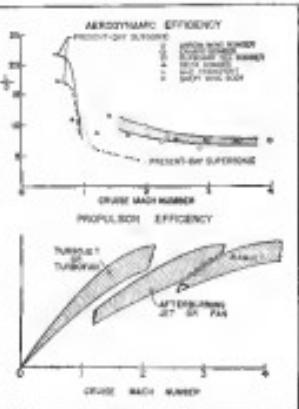
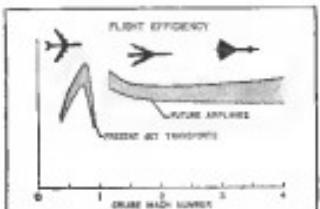
## Gains Promise Supersonic Nuclear Flight

This is the third of a series of articles on the various applications of nuclear power to aircraft and space vehicles.

Washington—Recent advances in atmospheric decontamination and cleanup techniques have made it possible to remove



CDEV compared to a radio-powered aircraft using divided shielding must be adequately reduced by its shield to protect the user from direct influence from noise and from influence scattered by the earth, the ground and the nearby structures.



**THESE** charts illustrate how improvements in manufacturing and production efficiency during the last five years have brought the opinions of various power plant clients closer to reality. Assessments of acquisition success has doubled and turbines with added life have reduced the need of power companies which are positive about Match 1. Total result has shown that the right choices of models approach seems a very close to that of ultimate goal (transports and benefits). A repetitive analysis reveals, therefore, will repair a stuck lever parts until this is done again than was thought possible a few years ago. Estimating into its acquisition results have doubled from a figure of time to about right during the last five years, a performance improvement which ends the pit-20 program possible.

point that each-pointed aircraft based on current technology can be stealthy and therefore would have limited value. They are

**Improved lift/drag ratios.** In the past four years, the lift/drag ratio for supersonic cruise has been doubled from a figure of two to about eight. This performance improvement results the 8% possible, and it also serves to make the jet-powered aircraft more competitive for nuclear-powered aerospace vehicles in flight.

+ Improved second-generation ducted fan engine technology. Development of turboshaft engines has reached an advanced state in the past three years. The very high propulsive efficiency of these engines makes it possible to

Total effect of these two developments has been to lower the thrust-to-weight ratio required for supersonic flight in the plane where the aircraft engine being developed by General Electric and Pratt & Whitney Aircraft can be considered for this purpose.

Concise Testbook

The seventh active nuclear aircraft project, the Convair XN-2 seaboat, scheduled for first flight in 1965, is essentially the same design with which the company won the Cessna competition in March, 1959. The Convair aircraft was to be a seaplane that

bottom without  
ing and low-level  
over authorized  
speech from any

as a testbed for some resistant air and ground handling procedures of our detailed specifications.

Statement	Percentage (%)
GOD EXISTS	95
HUMAN BEINGS HAVE FREE WILL	90
THE EARTH IS 4.5 BILLION YEARS OLD (GEOLOGY)	85
EVOLUTION	80
COLONIALISM WAS ALLEGEDLY A NECESSARY STEP IN HUMAN HISTORY	75
WE ARE ALIENS	70
THE EARTH IS 6,000 YEARS OLD (BIBLICAL LITERATURE)	65
THE BIBLE IS THE WORD OF GOD	60
THE BIBLE IS THE WORD OF GOD	55
THE BIBLE IS THE WORD OF GOD	50
THE BIBLE IS THE WORD OF GOD	45
THE BIBLE IS THE WORD OF GOD	40
THE BIBLE IS THE WORD OF GOD	35
THE BIBLE IS THE WORD OF GOD	30
THE BIBLE IS THE WORD OF GOD	25
THE BIBLE IS THE WORD OF GOD	20
THE BIBLE IS THE WORD OF GOD	15
THE BIBLE IS THE WORD OF GOD	10
THE BIBLE IS THE WORD OF GOD	5
THE BIBLE IS THE WORD OF GOD	0

**OPERATIONAL:** life of most engine systems in the mobile environment of a mobile naval submarine attack aircraft is shown above. This aircraft would have a divided shield if all equipment outside of the crew space would receive a substantial radiation dose originally most of the system shown would not function properly for even 100 kA-h in this environment. Even 10 years of development has minimized these life to figures shown.

## TI IN MILITARY ELECTRONIC SYSTEMS



A partial listing of equipment, designed, developed and manufactured by TI now operational in the Armed Forces includes:

1. B-57 Navy FRS-1 communications system produced by Lockheed—equipped with TI's first ADF-30 navigation receiver, AN/ARO-125A transponder, and additional gear (commercially classified).
2. TACAN/ADF-1 Airport Surveillance Radar for the Federal Aviation Agency.
3. Infrared receiver for the U.S.A.F. FAIRCHILD AC-12/Hercules 1000 hydrazine.
4. Quadrant photomultiplier stabilized by PDR data, noise, or medical instruments and improved resolution over prior hydrazine.
5. AN/FRT-1 RDA surface search radar, AN/FRT-2 integrated imagery detector for the U.S. Army GAF-1 AGM aircraft, built by Grumman.
6. AN/FRT-3 RDA surface search radar, AN/FRT-4 integrated imagery detector for the U.S. Army GAF-1 AGM aircraft, built by Grumman.
7. Countermeasures Device produced by PerkinElmer.

**TEXAS INSTRUMENTS INCORPORATED**  
APPARATUS DIVISION

to have a life amounting to 1,000 hr.

The NX-2 is expected to have a payload carrying ability of 90,000 lb. or better if professionals currently predicted for lightweight missile carriers can be achieved. There is every reason to believe that such performance can be realized in the future. The aircraft test work on the Soviet rocket engine has been encouraging, producing a test run at temperatures of 1,000°F using coal-tar fuel elements. It is possible to achieve much higher temperatures with boron oxide fuel elements if their oxidation and insulation problems are overcome.

Early estimates of nuclear aircraft performance by the National Aerospace Council for Aerodynamics showed that nuclear exhaust temperature of 1,000°F would be more than adequate for an aircraft in the NX-2 weight class if the propellent, engine, and storage rates were attained. Present data on engine thrust-to-weight ratios are still sketchy, but they set a key to the performance of any nuclear aircraft and they also indicate the performance growth that can be expected from follow-on models.

### NX-2 Thrust-to-Weight Ratio

In broad terms, however, the overall propellant thrust-to-weight ratio as projected on the NX-2 apparently is very good by current engine standards. Total propellant weight on the NX-2 with either the three or indirect cycle engines satisfied will be less than 50% of the total weight of the aircraft. This indicates the enormous shielding potential savings and savings.

On the other hand, fueled aircraft such as the B-52, the fuel weight represents 50% of the takeoff gross weight, and the engines account for another 50% or so.

On the basis of this estimation, the NX-2 will have an aircraft thrust-to-weight ratio that is better than the B-52 at takeoff. The comparison shows that the NX-2 is not only feasible, it is now considered by all involved as feasible.



Ethiopian Air Force F-86

Ethiopian Air Force F-86 shown is one of 12 delivered to Ethiopia last July. Trained by a mixed MAFF group of instructors, the air force played a major role in putting down the recent rebellion. At time of the attack, 27 DPs and about 1,000 Afghans

were in the field, but apparently it will also have a good payload capacity. The load capacity can be traded for speed requirements, especially if a follow-on aircraft configuration is selected with a direct combustion engine and with a state-of-the-art supersonic cruise of around Mach 2.5.

This measure is backed by extensive experimental data.

No further requirements of a range nature are expected in shield design. Statistical studies have been made of every conceivable shielding material and nuclear scientists report that there is no shielding breakthrough. At least there is some resolution concerning the best materials regarding the relative benefits of each.

But to date, the best has been accomplished with aircraft shielding as to compare the NX-2 shield weight with that required for a ground-based reactor of about the same size in the NX-2 case. The power output is assumed to be 100 hr. m. For the sake of comparison, the ground-based reactor would need a shield mass that 20 hr. in diameter weighing about 1 million lb. Radiation load on the outside of this shield would be soft gamma rays. Comparing the two shielding materials for optimum protection because it is cheap and effective, and its weight and bulk are of no importance.

Since it was originally anticipated to think of flying a shield of this size and weight, the success of the shielding in space programs was a key factor in the practicality of the nuclear aircraft. Through these programs, it was possible to get the total shield weight on the NX-2 down to less than 100,000 lb. For such a dimension and shielding cycle engine, even though these reactors will develop more than 100,000 lb. of power. With these factors the size of the NX-2 will not be exposed to a radiation dose as large as that presented for AEC's proposals.

The nuclear engine has four major

Mexican Air Force de Havilland DH-100 Vampire

Version Air Force de Havilland DH-100 Vampire Mk. III is one of a group of 15 jet-clad aircraft from the Royal Canadian Air Force. Around 20 new Mexican jet fighter squadrons are being established by Fiatavia, Inc., West Bend, Wis.

body at low encounter to carry shield weight down. The objective of shielding research has been to measure the understanding of these load paths so they may be applied to the heat advantage.

#### There are:

- **Design of shield mass.** Design must be made, whether the shield weight should be concentrated around the center, around the crew and equipment which must be protected, or distributed in all of these areas.

• **Selection of materials.** Materials must be used which will absorb the maximum possible radiation energy for a given weight of shield.

• **Conduction methods.** Several different methods are usually required in high-energy shields and they can be used in homogeneous materials or in separate layers.

• **Geometry.** Radiation pattern from an aircraft motor is dispersed in the heat structure, engine and equipment which are near the motor by an unshielded distribution of the shielding mass and its associated center gravity. Dispersal also takes place because radiation is scattered in the air during flight due to the air and ground during takeoff and landing. It is pos-

ible to save weight if the heaviest portion of the shield mass can be placed in the path of the heaviest radiation.

Most effective means of reducing weight is through distribution. There are two general classifications of shields as determined by the dispersal of their mass. This are:

• **Unit shield.** In which the entire shield mass is concentrated around the reactor. With this design the reduction in the weight of the shield is reduced to a one level for human.

The crew and the passengers of an aircraft using the unit shield could move about at will during flight, and the aircraft could be arrived smoothly upon landing. Deshielding of the unit shield is that it is extremely light and has a small cross section, and weight can be added well below the point of unit shield currently used with ground-based reactors. With current technology, one shield probably will be provided with the aircraft by mid-1960s with 100 kw power requirements. Early warning aircraft and 400 mph transports using transports at that range. If the unit shield de-power protection for such a unit could be designed well, it will be required to make them work.

• **Doubled shield.** in which part of the shield mass is placed around the reactor and just around the crew compartment. Shield weight can be lowered financially by using a doubled shield, rather than a unit shield. Doubled shielding will be used on the NK-2 and undoubtably will be used on the very high performance attack aircraft that will be developed in the future. Most favorable distribution appears to be about half of the shield weight around the reactor and half around the crew compartment.

Doubled shielding means that there will be two roughly equal radiation levels on the aircraft, a very low one around the crew compartment and a very high one outside. This is acceptable because the aircraft can fly about a thousand times more conceivable to radiation than most materials or aircraft structure and equipment.

Problems for doubled shielding are finding the crew to a relatively compact compartment for several days at a time, likewise, one conserving weight, loss of protection of equipment and components, exposing most of the aircraft structure, and in order to high enough radiation rates, simply makes other useful life difficult.



Saab Caravelle VI to Be Delivered in January

First Saab Caravelle VI is in final assembly at Saab Aircraft's Torslunde factory. Saab originally ordered four Caravelle VIIs, then reduced its order to six. The first is expected to be delivered in January, the last two in June. The Caravelle VI will have two Rolls-Royce RA 28 Mk. 6 turbines rated at 17,200 lb. thrust. These figures assume maximum takeoff weight to 40,000 lb. from 99,200 lb. for the Caravelle III which is powered by similar RA 28 Avons rated at about 16,400 lb. thrust.

these are surface parallel. They are orthogonally to the schematic light weight of the desired shield.

In the most basic terms, it is easy to explain the processes by which matter attenuates and absorbs the radiation energy from a nuclear source. The many elements, magnetrons, however, does not properly reflect the difficulty of the research which led to the discovery of caused shield materials and processes. Detailed study of the science and interactions between radiation energy and the atoms in the shield has proven extremely complicated, and it has involved endless experiments and computer work.

#### Two Types

Basically, there are two types of radiation from a fission reactor which must be reflected to protect the aircraft and its equipment. They are atomic and general rays. The basic processes by which they are slowed down and absorbed are:

• **Nutrition is slowed down through a series of elastic or billiard ball collisions with atomic nuclei. The lighter the nuclei that the neutrons strike, the greater energy they lose per collision. The slowing down or moderation process is used to generate hydrogen fusion reactions generally are absorbed into one of the atoms in the shield mass readily rather than have low energy. Neutrons, then, mean that the fast neutrons from fusion shielding have a high proportion of atoms with a low atomic number and light nuclei. Hydrogen is best in this respect, and water is an amateur that contains a high percentage of hydrogen atoms.**

• **Fission rays lose their strength through collisions with electrons. Therefore, a plasma ray shield should have a minimum number of electrons which makes the dense elements with high atomic number most attractive. Lead, iron, tungsten and tungsten are good general shields.**

Shield materials must be selected so that the basic nuclear processes do not absorb about 90% of the energy released in a fission reactor. The shield is subjected to very high heat loads and must be cooled. They are also used to carry aerospace loads at some depths so their great weight is not wasted structurally.

To study all of these considerations, the important factors in the selection of a shield material are: weight, density, low thermal expansion coefficient, high heat load, and heat sink capacity.

Light materials are not usually considered as shield materials, each of which is the optimum for stopping a slow moving radiation of a given energy level. For example, since light materials will slow or moderate fast neutrons very efficiently, while they have an adverse effect for absorbing and stopping slow neutrons.

Heavy metal isotopes would be an ideal shielding material except for one major fault. These substances will stop gamma rays and neutron effec-



Tunisian Air Force Saab Safir

First six of 15 Saab 91B Safir fighters and liaison aircraft ordered by the Tunisian government were recently delivered from Sweden. Safis above is shown in markings of Tunisian Air Force. Remaining six aircraft on order are scheduled to be delivered next year.

well, but are poor moderators. Each type of heavy gasiton is shielding also will perform better in stopping photons of a given energy level.

It is possible to use homogeneous shields in which the various materials are mixed together evenly. This has proved to be the lightest effective method available to solid mass, however, and it has been more efficient to use several materials arranged in separate layers or disks.

Layered shield design can be better for the nuclear standpoint because each layer can be specifically chosen to attenuate the secondary particles emitted from the inner shield as well as a portion of the radiation from the reactor. Control of the secondary radiation, released in gamma rays and neutron bursts around among the atoms of the shield material, is an important control of the primary radiation loss from the reactor. It is possible with ingenuity shield designs for the use

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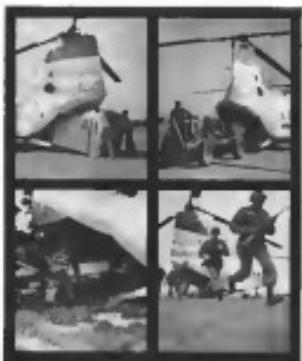


### CONVERTS FROM MINESEEPPING TO ASW IN ONE HOUR

The new twin-turbine-powered Boeing-Vertol 107 is the only helicopter flying today that can perform so many military missions—without costly conversion of the basic aircraft. The rear loading ramp and unrestricted cargo area permit a variety of modules or equipment to be quickly and easily installed on the 107, thereby enabling it to perform specialized missions for any and all military services. The Navy, for example, can use the Boeing-Vertol 107 for minesweeping and fleet stability duties and then, less than one hour after mission completion, convert to anti-submarine warfare—simply by installing Vertol's ASW module.

Whatever the mission, the performance-paved Boeing-Vertol 107 offers features unequalled by any other helicopter—150 mile-an-hour cruise speed... neutral directional stability at zero-strap-in for any-wind hovering... a Vertol-developed stability augmentation system (RASS) provides fixed-wing aircraft stability which can be augmented with a trim system for automatic flight... tandem-rotor design that minimizes down-wash velocities... ability to land and take-off from water without special flotation gear.

These are just a few of the capabilities that make the Boeing-Vertol 107 the first all-mission, all-service helicopter.



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### First Flight-Line Photo of Sikorsky HSS-2s

First flight-line photo of the Sikorsky HSS-2 twin-tail HSS-2 transports now in production for U.S. Navy emphasizes the large, low-set tail necessary to contain the atomic gas can in the primary section. Standard cruise profile, featuring two-hour cruise and two-hour hover, have been shown as an example of the flight test and performance plan progress. Gross weight of the HSS-2 is 27,000 lb; the powerplant is a pair of General Electric T58-GE-10 turboshafts currently rated at 1,320 shp each.

Similar solutions to upgrading current types of primary radiation and exposure protection gas striking the outer limits of the shield.

Landing gear can provide weight benefits if the heavy gurney can prior to landing can be placed close to the aircraft so there's room to leap to a minimum.

Mobile radiation-shielding research and shield research has yielded the point of diminishing returns and that little new information of importance will be gathered on shield smooth-faced construction and the relevance of shield mass. The only significant weight reductions are expected through detailed work on specific aircraft designs in which the effects of shield position and the overall structure are considered simultaneously.

### Use of Geometry

Most important and elementary use of geometry in aircraft shielding is to keep the crew and sensitive instruments outside a maximum distance from the reactor. Radiation may travel in straight lines, or they spread apart quickly as they leave a radiation source such as a reactor. As a result, a point of impact need not cross the centerline area of one aircraft seat but require a greater distance between the aircraft and another than a reactor than if it were located far away.

The proper mathematical statement to describe this effect is that radiation flow is energy transfer of particles

along the spreading of radiation rays with distance. There is a limit however to its effectiveness as a shield. Structured weight of the fueling surfaces as the distance between the crew shield and the reactor shield is increased. It should also be noted when less weight is added to the reactor shield weight than to the fuselage, the fuselage is where a particle reflection or reflection dose for the crew.

Two dimensions impacts with a decreasing fueling surface ratio and a relative power similar to that of the NTS; the maximum planned distance between the crew compartment and the reactor core is between 180 and 140 ft.

Shield shielding is another radio device. In addition to the passive shielding system the reactor is provided with a series of redundant indicators extending toward the crew compartment or other areas containing redundant sensitive instrument sets. Shielded shielding may be provided by increasing the thickness of the aircraft shield in certain spots or by placing heavy structural components near the reactor to then block off part of the radiation in a specific direction.

It is possible, for example to locate the wing spar on a sweepwing airplane so that the radiation from the reactor would strike the wing spar instead of the aircraft shield for the crew compartment. Heavy filtering and beams sealed to reduce the reactor shield in the crew compartment area are also ideal for use as radiation shields to protect the crew and aircraft systems.

### Shield Shield Requirements

The shield designer must select an appropriate material to use which provides shielding and minimizes secondary effects. He must be able to predict that radiation levels at given points of interest in the aircraft will be 100 times less than at the maximum values and 10,000 times less than the radiation intensity 1 ft from the shield.

The shield itself consists of multiple layers of lead and other materials to absorb radiation as it passes through the aircraft.



### First Middle East Airlines Comet 4C

First of four Comet 4C freight transports for Middle East Airlines, powered by four Rolls-Royce Avon engines, made its first flight last month. Aircraft is scheduled to commence regular service for Middle East this month. Other three Comets are under construction.



### Helicopter Winched to Destroyer Deck Landing

Kramer Aircraft Corp. has completed a series of sea tests of a windlass hoisting system for destroyer-based helicopters, using a remote-controlled HKK (hoist) and a safety pilot flying hook-off. Kramer uses the series version one of 400 lb constant torque cranes on a cable strung below the helicopter's center of gravity; aircraft is raised the instant both ends contact the deck. Cable is dropped about 16 ft above the deck, reeled through a switch block over the center of the hoisting pul and then wound up by the constant torque which maintains a steady pull, cable strength is about 35,000 lb, as required in Spec. Kramer has made the system part of its Superion II fleet helicopter proposal for U.S. Navy's ASH-2 program (AW, May 23, p. 21).

Ball-type influences within the shield, aircraft structures as molecules and the ground. It is possible through these influences to completely reverse the direction of a significant percentage of the radiation particles. Therefore, the radiation level at each point on the aircraft will vary with the direction under consideration.

### Crew Area Penetration

If the crew compartment is considered in an example, the heaviest portion of the radiation follows a straight line from the reactor shield. Some of it is reflected by simple collision with the structure, the air and the ground. If the aircraft is heading tail-on. Another portion of the radiation penetrates multiple scattering events. These are the multiple reflections and refractions which take place within the aircraft structure from all directions and it must be shielded on the sides and in front as well as the rear.

If the crew is to be allowed direct vision forward rather than using periscopes, the windowsills in their compartment must be efficient nuclear shields. The rear section of the crew compartment will require as the shield to stop the heavy streams

from radiation as well as northeast particles. The range of the scattered particles striking the index, top, bottom and least of the crew compartment is relatively low because radiation strength decreases as the scattering angle increases.

Design and weight of the crew compartment are dependent primarily on a possible to protect scattering. A number of monolithic and monolithic studies have been made of the scattering and absorption characteristics of various materials and the ground. Such studies were established the probability of these base events taking place in the various media and the probable influence the radiation incident will have on the structure.

Generally, there was enough doubt about these laboratory experiments and computer studies that it was felt best to use the aircraft as the sole basis for an aircraft shield design. To eliminate this uncertainty and establish a practical check on its shield design methods, the ANP group conducted a special flight program.

A modified Convair B-36 was used

in the program. It had a reactor which could be operated over a fairly wide power range, and the reactor's shield arrangement could be varied experimentally. The crew was carried in a heavily shielded compartment in the nose.

Radiation measurements were made in flight and ground gamma-ray sources were used to differentiate between primary and scatter. It was also possible to isolate the effects of air scatter from structural radiation sources by flying the aircraft at high altitudes where atmospheric density was so low that air scatter was negligible.

### Static Tests

Static tests concerning air and ground sources were made with a lower facility at Oak Ridge National Laboratory. That facility allowed the reactor and crew compartment to be separated with various separation distances and at various heights above the ground. The towers are high enough to allow the ground source to be completely eliminated as only air scatter will remain. It would also be possible with the test facility to separate upper aircraft structural components between the reactor and the crew compartment and get structural nuclear substantiation.

Good compilation of data from the



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various ground studies and the flight program showed that it would be possible in the future to use the basic system, small laboratory experiments and computer programs to design and prove the validity of shields for specific aircraft without flight tests. It is expected, however, that it will be possible to take great strides forward after they are flown.

The shield flight test program with the modified B-52 started the flight program September 1955, and continued to March 1957, when all of the test objectives were met and the program was terminated.

One of the most important points regarding detailed shield design is its simplicity and the very large number of variables that must be considered. The main objective is to get to the point of minimum area where the shield weight is minimum. Thrust-to-weight ratios for a given engine power is dictated by inlet air duct design as well as the shield configuration. Pressure drops in the duct must be lowered along with the shield weight or system efficiency does not benefit. ♦♦♦

## Douglas Flies First

### Turbofan DC-8 Jet

Long Beach, Calif.—First flight of the Series 50 Douglas DC-8 with Pratt & Whitney JT3D turbofan engines was made recently.

Developing 18,000 lb. of thrust at sea level, the fan engine enables a shorter takeoff run and has a better specific fuel consumption than current Series 30 DC-8s. The new engines are 30% more powerful than the old ones. M. R. G. Dutch, Arthur, Bureau d'Aviation Aeronautique du Mexique and United Air Lines, pointed out reasons she would be powered with the turbines.

Douglas Aircraft expects the first production aircraft with turbines to fly within 40 days.

Minimum gross weight of the intercontinental Series 50 is 111,000 lb. with maximum takeoff weight of 140,000 lb. The standard Series 50 DC-8 will gross 176,000 lb. with a range of 5,500 miles. Cruise speed of 600 miles will be 355 mph.

### Douglas and Boeing Order Eclipse Pioneer Autopilot

Eclipse-Pioneer Division of the Douglas Corp. has received orders totaling \$4.7 million for an unpowered auto pilot which is now in use on several of its commercial aircraft and five military aircraft. The autopilot is a derivative of the \$4 million system from the Douglas Ya-craft Co. for flight control for the NASA A3D Skystreak, and a \$2.9 million order from Boeing Airplane Co. for systems for the Boeing 727 and 728.



## Kinetics motor-driven switches provide maximum reliability for missiles and aircraft

This 2-pole double-throw switch Model H-114-1, features the Kinetics motor-driven switch design to achieve ultra-reliability for missile and aircraft applications.



For any missile or aircraft application where absolute reliability is a must, specify Kinetics motor-driven switches. They are available in a complete line of sizes ranging from single-pole, switch-thru to 100-pole, double-throw. The design is extremely compact and light-weight. It can be used with any type of power source. The 100-pole, double-throw model weighs only 5 lbs.

Kinetics switches are used in missiles for mode power changes, range safety systems, distract circuit, telemetry equipment, battery switches and a multitude of other uses. Switches are now being supplied for three major intercontinental ballistic missile programs, one land-launched and one submarine launched intermediate range ballistic missiles, two space-manned programs and three space vehicles.

Kinetics switches are frequently specified as a replacement for relay

to insure absolute reliability. There are no breaking stresses or annual relay elements of any kind to cause trouble. Relays may be transferred at 40 G's, 10 millisecond rate. When they are transferred, no power is required to hold them in position, insuring 100% reliability.

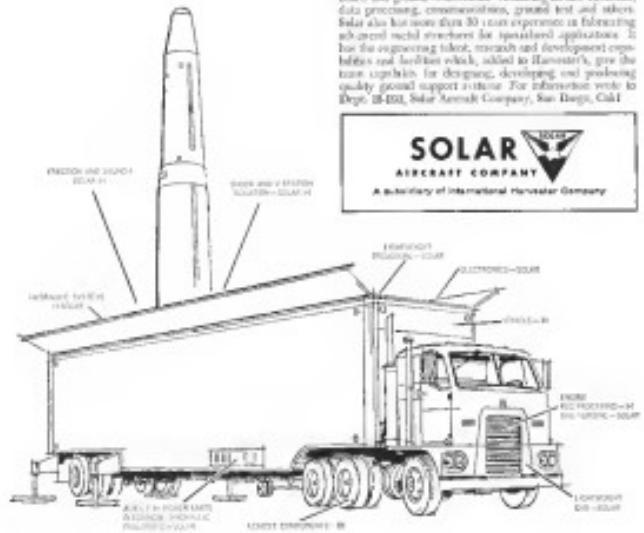
The vertical switches contact starters over the entire vibration spectrum, from 5 to 2000 cycles, 40 G's. Voltage drop across contacts is less than 10 millivolts at 15 amps. Relays are available with extremely fast transfer times of 25 milliseconds. The help with your missile requirements, write to phone Kinetics Corporation, Dept. X-A-1, 419 S. Cedros Avenue, Redondo Beach, Calif., 90278. Tel. 3-2168.

**KINETICS**  
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# A new team for complete ground support systems

The new team of International Harvester and its subsidiary, Solar Aircraft Company, has the unique capability of designing, developing and producing all major components of complete ground support systems. Most prime contractors in the ground support field produce one or two major components and then source requirements for the remainder of the system from numerous subcontractors. International Harvester's ability to design, source, manufacture and assemble a variety of products including heavy delivery and even liaison to meet specification. Solar and Marquette, however, have direct control over both production schedules and the quality of the equipment they produce. A typical example of a ground support system being studied by the team is a mobile remote launching station such as the one illustrated here. In such a system Harvester would have responsibility

for the truck, chassis, boom, equipment and any recuperating engine involved in the concept. Solar could produce the specialized missile launching equipment, lightweight components of the carriage, electronics, launching and tracking transmitters, and gas turbine auxiliary power units. Marquette is the prime supplier of the mobile control module in the launch station. However, in this a wide variety of mobile vehicles and construction equipment including crawler tractors, bulldozers, large, mobile load carrying and materials handling equipment. The company has the size, personnel, facilities and financial resources necessary to handle complete ground support system contracts. World wide sales of the company last year were nearly \$175 billion, and employment was more than 100,000. Solar Aircraft Company is a leading producer of gas turbine engines and vessels and aircraft components. It produces complete electronic systems for airborne shipboard and ground communications, including atomic electronic data processing, communications, navigation and tracking. Solar also has more than 30 years experience in fabricating advanced metal structures for specialized applications. It has the engineering talent, research and development capabilities and facilities which, added to Marquette's, give the team capability for designing, developing and producing quality ground support systems. For information write to Dept. B-100, Solar Aircraft Company, San Diego, Calif.



# Germans Plan Combat Unit Modernization

By Cliff Branson

**ENCL-Prüm:** West Germany's air force plans, skipping license of production delays, will be for the complete modernization of its combat wing structure with Lockheed F-104Gs all-weather interceptor-fighter bombers and Fiat G.91 close-support attack aircraft by 1965.

Total force at that time, if plans remain unchanged, will be 100 fighter-interceptors and 100 close-support aircraft, 1,800 combat jet pilots. Qualitatively and quantitatively, this should put West Germany at the strength it has been for within western Europe by the 10th anniversary of its reactivation in 1955 with a matching of sharply obsolescent tactics and a nation of armed retired World War II pilots.

More than 700 of these aircraft will be F-104s and about 220 will be G.91s. The first 100 F-104s will be delivered to staff of the production lines here by mid-1963; the first F-104G by late 1963. Initial quantities of both, however, already are being delivered from the U.S. and Italian production lines.

## NATO Wings

At present, the air force has 12 activated wings, of which six have been assigned to the operational training unit of the North American Aerospace Defense Board. All West German forces now may be NATO-assigned, under general treaty obligations with the United States, Great Britain and France, the other wings will be put at the disposal of Supreme Headquarters Allied Powers Europe in this liaison experiment.

The jet combat force now is being downsized from more than 900 aircraft, at varying stages of obsolescence, to the Soviet equivalent. This would leave four combat wings. One of these is the reorganization of the air force's last bulwark in the fact that some pilots are still being trained for the Republic F-86 and North American F-86 while others are being introduced on the F-104 and G.91. There are no steps or latrines.

Rearring wing structure provides

- Three intercepter wings of Canadian Solar 5 and Solar 6 aircraft, one of which is experimental and has been assigned to NATO. To speed the reorganization, Canada has designated 12 Solar 5 and the German government produced another 225 Solar 6 day fighters. The two Solar 6 wings, still on training, will be equipped with advanced versions of the Sidewinder air-to-air missile being produced widely in Europe.

AVIATION WEEK, January 2, 1968



SEVENTEEN F-104Gs have been delivered by Lockheed to the West Germans air force at Neuweiler, and training of student interceptors is well under way.

to a cooperative effort by six NATO countries, including West Germany.

- One all-weather fighter wing of North American F-104Gs. Eighty-eight aircraft for the wing, which is still in training and represents Germany's only present fighter-interceptor force, was manufactured under license by Fiat and purchased by the air force.

- Five fighter-bomber wings, four of which have been assigned to NATO, with a total of 416 Republic F-84Fs aircraft made available to Germany in the United States on a general basis.

- Two reconnaissance wings with a total of 108 RF-84Fs also made available on a general basis. Both wings are still being converted.

- Two transport wings composed primarily of North American Transports. One has been loaned directly to NATO, the other is still in training.

Part to go in the all-weather F-104Gs begin to trickle in will be the F-84F fighter-bombers followed in turn by the B-57B's, the Sabres and the F-104. Currently at present, half of the combat wings are still on training, and the five planned for the G.91 will all be ready next month.

Ultimate manpower goal for the air force is approximately 180,000 men, of whom 140,000 will be in combat, 6,000 in support, one thousand in administrative definition, in requiring qualified personnel. The NATO goal of 15 pilots per aircraft has been met in one of the 12 activated wings, and it is hoped that a monthly rate will be reached in all of the 15 wings presently planned.

Tug air force officials, aware of what believe that the politically tenacious exception period may have to be extended will well into the present 12 months and other interceptors will be made available to prospective volunteers, place major blame on two factors.

A West German youth and家老一代

which, added to the debris of

World War II, would like to be pacified. "The U.S. adapted its war

to the air force," he said.

• There is virtually no unemployment in West Germany, wages are relatively high, working conditions usually good.

• The cost of living is twice as much as in a country having employment is virtually nil.

## Site Year

Another possible解释, but not viewed as necessary here, is the fact that a youth who wants to become a pilot-citizen non-commissioned or an officer-citizen agrees to serve a minimum of ten years. Under such a contract, the air force generally has the right that a recruit can be released after three years of protective service, thus spreading versus the more time training.

The air force originally had hoped to reach an 1800-plane goal, with a substantial number of F-104s and G.91s delivered by late 1963. Those produced by the home factories will, of course, be sensible to the air force, but looking for licensed production has been slowed by the extensive modifications in the basic designs of both an-



### Lockheed Hercules Launches Ryan Firebee Target Drones

**L**ockheed GC-130 Hercules takes off from Tyndall AFB, Fla., carrying four Ryan QDR subsonic-payload target drones, being used under the wings. Hercules can take the drones in 30,000 ft, but dropped the Firebees from 18,000 ft, for the particular flying mission. Drones thus climbed to 18,000 ft. Axial-flow drone now flew 180 drone missions at Tyndall and Holloman AFB, N.M.

raft to meet the particular military needs and requirements of West Germany.

The air force's greatest headache remains as the guarantee of the potential enemy which could suddenly land down aircraft taking off from their home bases with nuclear missiles fired from over East German territory. The threat of ballistic missile attack against the airfield is even more apparent.

Ironically, as long as planners logic is to go to war in front of V-100 weapons systems that have been developed and hidden (AW Nov. 3, p. 73). As a step in the direction, current policy calls for the establishment of a single-hardened line for the G-91s with full dispersal sites for each wing in times of alert. The G-91s will be necessary armament to vulnerable airfields with their long, evasive flightways that make interceptors responsible.

An air force spokesman responded in a letter to reporters that some of the measures are aimed at "protecting" West Germany, however, in view of integrating its operations with a NATO organization for Central Europe encompassing France, Germany, The Netherlands and Belgium. Forces for the operation will include the assets of the respective countries plus Nato and West German assault troops on sites at all four airfields.

Nato should be operational, and West sites probably will begin operating within 8 months if German forces here-and-there remain VTOLs up just after the first of the production of land-based sites in an occupied country where property is similarly treated.

Most obviously, as operational, and West sites probably will begin operating within 8 months if German forces here-and-there remain VTOLs up just after the first of the production of land-based sites in an occupied country where property is similarly treated.

Safety of fuel also problems the

maneuver of assault teams in Germany. So the moment, at least, assault crews must be sent to the United States for their planning and enhanced procedures in order to live a practice mission. This and the interests of the West Germans are the major reasons Germany looks at least look elsewhere to find adequate training sites and logistic supply depots.

Precise training space available in West Germany totals 393,150 sq km as opposed to an estimated 87,000 sq km available in France and West Germany.

Although still a lonely area in some areas, Germany or West areas can have been partitioned to qualify it into such places as Silesia and Thuringia for gunnery training. A number of supply depots have been packed away in other West European countries further south from the border, and France and West Germany are regarded as the principal areas of the former strength of the former Luftwaffe.

The first F-104G arrived at Neuendorf on Jan. 10/10, 1970, and John E. Eising, air base commander, said the first total man swap back to F-104s since 1965 had been completed by the German air force. Two will return to Palmdale for the present to check out German fighter acceptance test pilots; a third will be shipped to the maintenance school at Kaiserslautern.

Aside from those training details, there 27 planes will be organized into a strikeforce: German fighter-bomber squadron-35, See aerobatic plus one spare.

Airline for the F-104 is carried in the United States by Lockheed in T-38D transport aircraft coming from Neuendorf at base approximately 10 mi from Bonn could be over the East German border within 12 min. On a high-altitude, high-speed flight from

Neuendorf to the air force training command-Kommando der Schule für Luftwaffe).

Training of Neuendorf students will follow the same general pattern as that given to the instructors and a reported to require approximately three months for each group. Classes, hopefully, will be limited to about 16 students, or there to no maximum.

Student training program begins with 72 hr of ground training with the greatest number of hours going to the engine gas, heating and fuel system, navigation, communications and instruction which were similar with their task. Neuendorf, for example, which has responsibility for final assembly of 200 of the F-104Gs scheduled to be produced in Germany, having pilots trained to take over the flight-simulation tasks.

First six student-instructors for the F-104G were trained on the aircraft in the United States at Lockheed's Palmdale facility and at Edwards AFB, Calif. Four of these are American and two are German. All are experienced instructors at Neuendorf. At least two of the F-104Gs to be transferred to the United States in flight-simulation test flights, and so many Neuendorf crews will begin shortly to round out the number to 12.

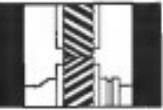
These 12, in turn, will begin training the first of an estimated 1,000 operational pilots needed for the F-104Gs sometime next spring probably in March. All instructors have a minimum of 400 hr, an operational jet rating and their first assignment will have at least 250 hr although this latter number of hours may decrease as the training program worn on and the supply of qualified pilots becomes strained.

Student contractors agree, however, that in the transition from the F-4F, "you are behind the airplane on the first few missions, and we hope we don't have to get anybody here coming straight from 'Fleet,'" (Lockheed) Eising.



North American Builds B-70 Panel

Interlocking panels for North American B-70 Mach 2 bomber is lowered onto a cradle at the company's Los Angeles, Calif., plant. Complex structure is 16 ft x 30 ft and is built on three planes in a "Z" pattern. Sections are chemically milled to reduce weight.

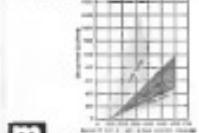


Early M-D blower designed for a matched pair of compressors, which had been built separately. Back date unknown to 1950+ by other blower makes and quality.

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## AVIONICS

# Computer Responds to Voice Commands

By Philip J. Klass

New York—Recent experiments by the Air Force Cambridge Research Laboratories indicate that it will soon be possible for operators to use voice to communicate with digital computers for speedy insertion of valuable data. This would suggest the possibility of a computer being able to talk directly to its operator.

In AFCLR tests, a small digital computer with a relatively simple speech analysis accuracy has successfully and consistently been able to recognize different spoken words. S. R. Petrik reported here at the recent Eastern Joint Computer Conference. The report was cosponsored by Mac II M. Willett.

Using this basic word recognition technique, AFCLR has successfully demonstrated that other linguistic functions can be implemented. • Simple language translation, in which a word spoken in one language is recognized by the computer, translated into a second language and typed out in printed form.

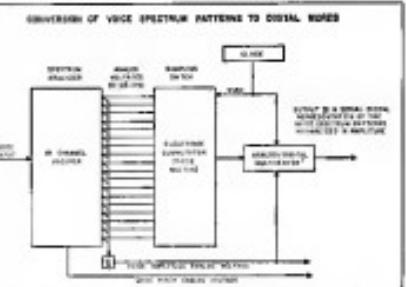
• Individual speaker recognition, in which the computer is able to identify which of several operators is talking from the characteristics of his speech. • Adaptive programs which enable the computer to automatically adjust itself to a different speaker's accent of talk.

• Mathematical problem, expressed in terms of symbols, plus, minus, times, brackets and equals, can be accepted in decimal voice form, with the computer recognizing the required mathematical operations and then performing them to solve the equation.

### Test Limitations

The computer used in the experiments at the AFCLR Cambridge Computer is a small machine with a 16-word read/write storage of only 1,600  $\times$  8. This limited the recognition tests to a vocabulary of about 50 different spoken words and required about 1.5 sec for recognition of each spoken word. Use of logic, faster machines would permit a greatly enlarged recognition vocabulary and much shorter recognition time.

The method used to recognize individual spoken words in the AFCLR experiments differs considerably from that employed by International Business Machines Corp. in its speech recognition system (AVL Oct 3, p 57). In the IBM experiments, the vocabulary was limited to 10 digits, zero through nine, and



VOICE COMMUNICATION with a digital computer, advanced by Air Force Cambridge Research Laboratories, uses a 16-word vocabulary and operates according to current voice spectrum patterns and digital words in storage and subsequent comparison with spoken commands to refer to recognize the word, and, in some cases, the speaker.

pronunciation was based on inherent phonetic differences between each of the digits—consonants or clusters of spoken sounds such as 'sing' (long /i:/) and their relative location in the word.

Cambridge Research Laboratories use a stored representation, called a mask, of each word which it is to recognize when spoken by the human operator who will talk to the machine. The mask is a time-sampled, spectrally-accurate plot of the word inputted digitally. The human operator normally will repeat the word several times so the machine can form a mask which can accommodate variations in word pronunciations and speech patterns. The operator then inputs into the computer the printed equivalent of the word he has spoken. The program is repeated until the required vocabulary has been stored in the machine.

When the stated vocabulary masks are prepared by the same person whose voice will communicate with the computer, his spoken words can be identified with almost 100% accuracy, Petrik said. If the subsequent words come from another operator, the degree of success will depend largely upon the similarity of the speech characteristics of the two individuals involved.

The technique used to analyze

spoken words and prepare stored words, described below, makes it possible to discriminate between different speakers on the basis of the manner in which they voice and enunciate words, AFCLR tests indicated.

### Test Series

To test this capability, AFCLR intersects word test code speakers and stored masks of each of three voices speaking the words "one," "two" and "three." Each speaker reads each of the three words a total of four times, giving the computer four samples of each individual's voice for the preparation of each stored mask.

After masks had been prepared for the 16 words, each of the three spoke the words "one," "two" and "three" to the computer, and the machine attempted to determine which of the 16 subjects was at the microphone.

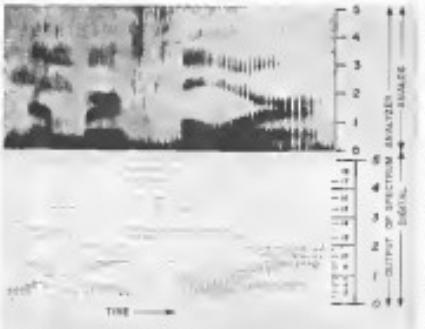
In the case of the seven subjects selected, the computer was able to identify each speaker with ease (over 99%), while for code subjects the machine could identify words more than 90% accurately. Average for the whole group, based on 283 spoken samples, was 94%. Petrik reported.

Encouraged by these results, scientists wrote another computer program, using the 48 word masks (16  $\times$  3) pre-

HITCO-developed fabrication techniques are providing options of the heat shield for production Atlas and Thor nose cones

Five materials enable first ICBM nose cone to be successfully recovered intact. Recovery temperature is 12,000° F. dual heat shields. April 1961. Photo by H. L. Thompson Co.

H. L. THOMPSON FIBER GLASS CO.



**SPECTRAL INTENSITY** of two spoken words, "number" and "four," is shown as scaling from an analog-to-digital input and as digital form below. Numbers along vertical axis represent intensity of sound energy passed by one of 15 bandpass filters to spectrum analyzer.

voiced steady. One of the 15 subjects would speak the word "one," "two" or "three" into a microphone and the computer would then automatically give one of the following types of response:

- That was John Deere speaking the digit three.

• Can't identify speaker, but the digit was three.

• Can't identify speaker, or the digit, digit or three.

A fourth possibility is when the computer identifies the speaker but cannot identify the word he spoke. It is not yet possible with the present system. However, there are four that it appears feasible with at least a fair degree of success and to under active consideration.

#### Adaptive Recitation

AFCL scientists developed two self-adjusting programs intended to enable the computer to adjust itself to a new speaker for which it has no programmed mask. The first requires a human operator to make certain decisions, while the second requires no human intervention. In both cases, the words of words which comprise the computer's stored vocabulary are spoken by one of a group of speakers.

Where a human operator is available, the computer uses a positive identification if the human operator can relate between a word spoken by a known operator and a similar word mask in its storage. If the correlation is not moderate, the computer makes its best guess, prints it out and asks the human

operator, the operator types the actual spoken word into the computer. The computer stores an stored vocabulary to be used if no such a word is stored. If so, the machine then modifies an original stored word mask to incorporate a larger fraction of the characteristics of the word just spoken by the new speaker than it would have done if it had made the correct choice.

If the word recited by the new speaker sounds completely different from any of the computer's word masks in storage, it asks the human operator to type in the word. The computer then adds the word just spoken and the human operator makes an memory to use it if it has much a word in storage. If it finds the word, the original stored mask is modified by a still larger fraction of the newly spoken word characteristics.

#### Computer Question

Whenever the correlation is so poor that the computer must ask for human assistance, either to confirm its choice or to identify the spoken word, the computer asks the human to repeat the word. If the human operator is unable to identify it, it is an increasing fraction of the word's characteristics introduced into the stored mask. If the computer still has trouble after several repeats, it erases step by step the region of the word; it replaces the original stored mask with the last repetition of the word.

The stored adaptive learning program, which requires no human intervention, subsequently adjusts the

amount of stored mask modification and the fraction of the new spoken word characteristics used in the modification, as a function of the amount of information between the stored word and the new or stored word. But the self-adjusting program may not always adapt to the new speaker's voice AFCL's test indicates.

Because it is so slow and quiet, to read word masks for a new speaker, it may be simpler to add a new operator to run through a brief training routine so that the machine program can read words taken in his manner of speaking, Pratik indicated.

One of the speech recognition techniques used by AFCL is a vocoder, consisting of 12 bandpass filters, which decompose each spoken word into 12 frequency steps in the audio band. The output of each filter goes in a corresponding spectrum analyzer which measures the power density of the sound in that segment of the spectrum.

The output of each spectrum analyzer therefore represents the magnitude of the sound energy in a segment of the radio spectrum. The output of the spectrum analyzers will vary with the intensity of the voiced sounds.

The output from each of the spectrum analyzers is sampled in sequence by an analog-to-digital converter (multiplex), then converted into a three-bit binary number which represents its amplitude.

The rate at which the spectrum analyzers output are sampled, and the number of such samples used in passing the stored mask, depends in part

upon the number of words in the optional vocabulary and the relative difficulty of discriminating between words sounding words. The larger the vocabulary and the more difficult the words, the higher the rate and the larger the number of samples used in the stored mask.

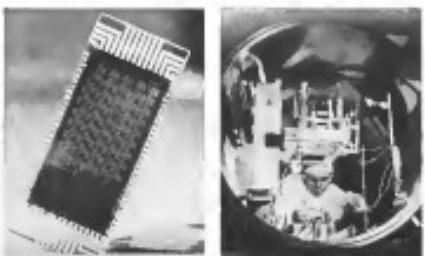
In AFCL experiments, the sampling rate used was 50 per second. The number of samples of each spectrum analysis output used in the stored word mask was varied between three and 15 per word.

Besides all of the different databases

of different words,说话机 used was used so that the stored mask of every word would have the same number of words.

AFCL's interim research experiments intended to evaluate the capture accuracy of word and word recognition as a function of the number of samples per word and in the stored mask and as a function of the number of frequency segments into which the voiced word was decomposed. The latter included decomposition into 12, nine, six and three frequency channels.

Following are some of the results of



**IBM Produces Thin-Film Memory Plane**

Cryogenic thin-film memory plane (left), consisting of 155 cryogen elements built up in 19 layers, featuring 40 bit storage plus access and read/write between memory planes, has been developed by International Business Machines Corp. using new thin-film coating technology. Workstation (right) is a computer workstation for programming at room temperature. Fabrication of this thin-film memory planes is carried out in refrigerated assembly tool (right) by means of sequential deposition processes using 17 automatically adjusted masks. IBM says that process automatically produces duplicate memory planes with similar characteristics since the masks have been properly aligned. Total is equivalent to 18" x 18" in. Hg.



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#### ACCESSORY OVERHAUL



**Univac Thin Film**

This film memory will perform control functions in new Univac 1107 ThinFilm Memory Computer, providing access time of 100 microseconds, less than half that required for magnetic core memory. New computer uses double access for auto memory, provides 15,344 to 95,536 words of storage. The new solid-state memory load data processing system will cost for \$40,000 to \$60,000 per month.



### Ocean-Based Vartac Navigation Aids Tested

Ocean-going Vartac on the Coast Guard Cutter Andromeda has just completed three weeks at Ocean Station Charlie, 390 miles northwest of Greenland, as part of Federal Aviation Agency's program to evaluate use of ocean-based Vartac navigation aids across the North Atlantic. Nearly 200 aircraft used the Andromeda's navigation services during their week at port. Ship carries a VOR, homing and TACAN transmitters, providing service for both civil and military aircraft. VOR antenna (1) mounted atop a 75-ft mast with 100 ft diameter counterweight below, is not rotated or pitch or roll, while TACAN antenna (2) atop a tripod mast is stabilized so ship will tilt up to 30 deg. Both are connected for changes in the ship's heading.

These tests, using spoken digits "zero" through "10," which allow one digit of ranging, the number of samples per word and the number of frequency segments.

- 96.7% recognition using one sample and one frequency channel
- 96.1% recognition using one sample and three frequency channels
- 100% recognition using two samples and one frequency channel
- 99.9% recognition using five samples and three frequency channels
- 94.7% recognition using three samples and three frequency channels
- 98.8% recognition using four samples and three frequency channels

Because of unique difficulties in the Canadian Computer, spoken digits (word) were limited to no more than two seconds duration in the MCRL test.

Words of greater duration could be handled with a computer having greater storage, but words still must be spoken as individual words separated by distinct pauses, or means must be developed to "logram" continuous speech into distinct words. Petrick and Ward on this investigation problem have been working on several groups, he added.

AFCRL currently is considering the use of a larger scale computer and a 500-word vocabulary for further evaluation of techniques for voice com-

munication recognition techniques. "We're trying to indicate a great promise for rapid advancement in oral communications via with digital computers in the near future," Petrick concluded.

Beth Petrick and Mrs. Willett are in the Computer and Mathematical Sciences, Lifesciences, Electronics Research Division of the Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Bedford, Mass.

### Quartz Crystals Being Produced in Quantity

Mass production of synthetic quartz crystals has begun at Western Electric's Monmouth, Illinois Works factory at North Andover, Mass.

Crystals, used in frequency-stabilized oscillators, are grown in 20 10-ft long, 14-in. diameter tanks. Seed crystals of either cut or uncut quartz are suspended in a gas half way up the lower half of the tank, with chunks of artificial quartz. Water which solution is poured over the chunks and the vessel then heated to 1,300°.

Quartz crystals dissolve under heat and pressure (approx. 25,000 psi), rise to the center upper half of the vessel and then redeposit on seed plates.

The overall cost of crystals represents their weight.

Western Electric now produces 700,000 crystal units approaching 14 in. long, 14 in. square, from 10,000 lb of raw silicon quartz monthly.

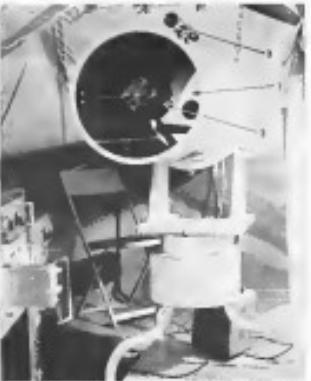


### Fuel Cell Performs in RDX-2A

Fuel cell developed by General Electric's Marine and Space Vehicle Department performed successfully under zero-growth conditions during 30 min flight time of General Electric's RDX-2A research vehicle. Unobstructed illumination, measured on axis in photo, showed no reduction in voltage or current to flight. Step change noted occurred when solar load was applied to the battery at apogee.



**SOLAR COMMUNICATION** transmitter (left) part of experimental solar communication (SOCOM) system (AW May 2, p. 154) developed by Electro-Optical Systems, Inc., under Air Force contract, gathers and filters light, modulates and transmits it to receive 8 mi out during recent Mojave Desert tests. With present filter system, modulated transmission covers millions of miles in space. Receiver of experimental solar communication system (right) consists of a double source system: a photomultiplier, liquid processing and confocal gear. The source system is a Coherent-type laser, one in which light impinging on a parabolic mirror (1) is reflected to a second mirror (2) and focused back through a hole in the first. Receiver with photomultiplier (3) for measuring solar power is shown inside a tent during field tests in the Mojave Desert.



### Solar Communications Prototype Tested

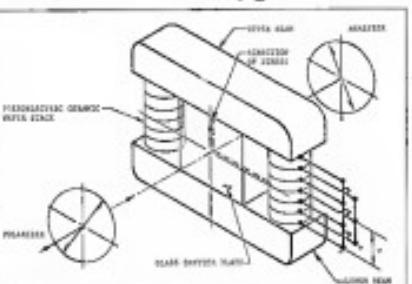
By Barry Miller

Edwards AFB, Calif.—Desert field tests of an experimental communications system which employs the sun's light as an omnidirectional carrier recently demonstrated the feasibility of obtaining long-distance space communications using optical frequencies.

The tests were conducted at the Mojave Desert last year by engineers of Electro-Optical Systems, Inc., of Pasadena, Calif. Equipment used included a prototype of Electro-Optical's SOCOM (solar communications) system (AW May 2, p. 16).

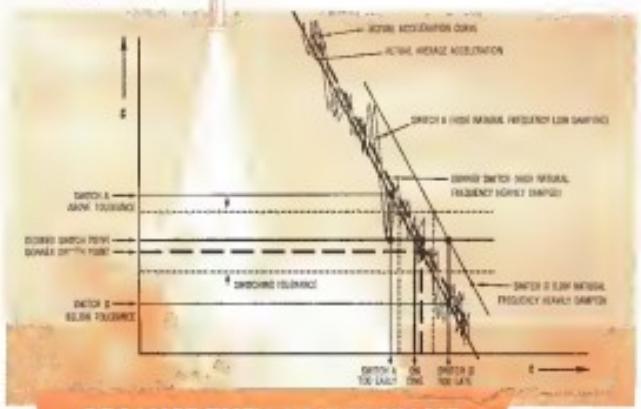
The equipment was developed for the U. S. Air Force's Wright Air Development Division under an AF-33(67)-134 contract.

Pages of the tests was inability to set up prototype equipment satisfactorily and to show that optical systems are suitable for space communications. An eight-inch, line-of-sight, optical system of desert sand was selected for the test because of the absence of background light along the transmission path and the absence of dust.



**MODULATED VOLTAGES** applied to photoelectrics (diodes) (arrows) make produce strong 100-hr beam supporting a erosion glass plate of the etched plate device. These strips also optical properties of glass, shaping plane of polarization of light passing through the electrokinetic modulator employed in solar communications system. The modulator makes possible the transmission of information by the solar communications system over modulated distances of at least 2 million mi.

## There's only one reason to specify Donner acceleration switches



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Look at the graph above. Under static conditions, switch "A" with a better switching response, might be desirable. But suppose the switch were experiencing a 10 g vibration of a high frequency impact and proper linear switch disposed on detecting a 2 g switch point. Switch "B" would eliminate the problem of early switching, but introduce undesirable phase shift; which in turn would make the switch "out" the event after it actually occurred. In other words, under the dynamic conditions of missile and aircraft flight, it is absolutely necessary to know when an event occurred rather than precisely where it occurred. Frequency response becomes a more important consideration than switch accuracy.

Mostly designed with a high natural frequency, Donner acceleration switches have low phase shift providing the transient response necessary to follow rocket engine

operations and perform their task with meaningful accuracy.

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Forces isolate multiple switch points, say specified damping rates, built-in time delays to overcome initial transients or delayed output, memory damping, and total programming capability.

**See Page Revisions in Appendix—For complete technical information write for our new brochure, "Accurate Acceleration Switches for Missiles and Aircraft," Technical or Missile and Aviation Product Division, Dept. 39.**

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from atmospheric absorption or scattering.

Long distances over which they are other optical systems might be considered. In space such would be attained by attenuating the intensity of light beams with special filters located in the transmitter and the receiver.

According to Electro Optics, test results with this equipment indicate that:

- Information can be transmitted at least two to three miles into space using a transmission rate of about 10 bits/sec. of waveform code. Light signal with an information rate of 10 bits/sec. was sent over 10 microns wavelength. Information could be transmitted over the latter distance, Electro Optics say, by installing larger transmission collector mirror than the 12-mm reflector now employed. Various distances were recorded by use of suitable filters chosen on the basis of inverse space law calculations.
- Signal noise ratio of 16 db (measured to the waveguide photodiode output) was obtained for a selected transmission distance of 1 million m. (Read-with was 10 sec.)

Communication and radar systems which use optical (beam) light, infrared or ultraviolet either than conventional radio waves have attracted special attention in the past two years. In space these systems would be free of atmospheric effects which would severely curtail their usefulness in the normal application. Possible value is seen in long distance communications and achieving confidentiality in messages passed by means of beams of light. Additionally light weight, reliability and low power needs of optical and associated electro-optical or electronic equipment are among other advantages frequently claimed for optical systems.

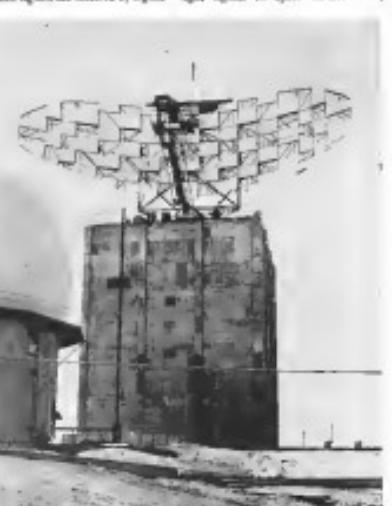
This growing interest in optical wavelengths for signal gathering systems was further stimulated by recent success in generating relatively intense light with lasers. Much interest in space should provide more accurate, high intensity lasers than ion beams handled by SOCOM. Beam width of light generated by Bell Telephone Laboratories optical fiber (AW Dec. 24, p. 75) was 0.1 deg. This is 0.1 the width of the 4 deg. beam of sunlight gathered in by SOCOM's glass collector lenses and employed as the basic source.

Several weeks ago Air Force outlined its requirements for a new generation optical Mars transceiver (AW Dec. 5, p. 92). Under the SOCOM system, this device would radiate on the sun as a pump or power source for an optical Mars whose output would be the same frequency concept. Small contracts, probably less than \$50,000 each, are expected for the non-powered transceivers.

periodic waves, reflected back against a second mirror in the Cassegrainian optics and reflected through the objective in the first. Signals are detected by a photomultiplier conveniently positioned and read out. The receiver's field of view is four square meters.

Total power required by the transmitter is roughly 10 watts, about equal to light from a standard incandescent lamp. Operating in vacuum SOCOM coupling lighter waves in place of the glass wave case used is expected to weight between 30 and 40 lb., company engineers say. As part of a separate project, but applicable to SOCOM, the company fabricated a 3-ft.-diameter mirror displaying high optical quality. Density of this mirror is 33 db.

At the receiving end, transmitted modulated signals are received by a light



### Air Defense Command Radar Site at Montauk, N. Y.

Sperry PTP 31 long-range surveillance radar antenna at US Air Defense Command's Thule Radar Station, Montauk, N.Y., is 30 ft. high, 12 ft. wide and is mounted on a 35 ft. tower. This fixed-priority search radar is part of Air Defense Command's frequency diversity program, designed to insure an easier to spread, and thereby weaker, its jamming power, or for maintaining an income in noisy airborne ECM equipment. Institutions in case of 100 decibels diversity values pleased to be operated by mid-1964.

they do not resolve the difficulty to launching a receiver (or acquiring a target) registered as a major bombing block in this field (AWW Dec. 16, 1956, p. 37). Because of the large distances over which the system would operate, it appears that the introduction of optical lenses, some surface superposition techniques might be needed.

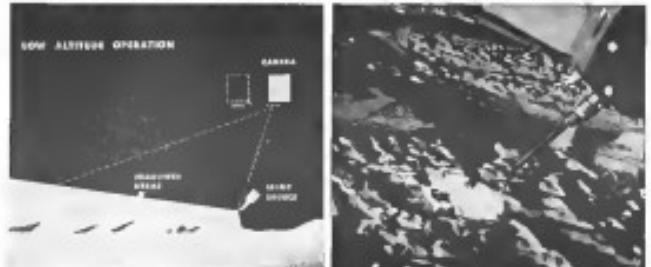
Among the several modulation evaluated during the field tests, the most promising, engineers have say, is a crystal analog of the Kerr cell. This is called a strained plate shifter. The Kerr cell is one of several types of modulators suggested for aircraft communications (AWW Feb. 22, p. 63). Noteworthy, in the Kerr cell, a liquid-

usually nitrobenzene-stabilized by two electrodes is placed between two polarizers.

Axis of the polarizers are so aligned that light does not pass through them. Applying a potential across the electrodes changes the birefringence properties of the liquid, so that polarization angle may be varied as a function of the applied potential.

Compared with the Kerr cell, the strained plate shifter, according to Electro-Optical, requires less voltage (by a factor of about 10), is safer, rugged and does not employ a toxic liquid.

A glass plate replaces the nitrobenzene in the strained plate shifter. Necessary changes in the index of reflec-



**RADEAR** for Republic F-105 simulates over high altitude light source illuminating relief map of target area and a simulated television camera to produce similar ground mapping radar operation at all altitudes, from base level to 100,000 ft. Light source moves over relief map, corresponding to aircraft position, and moves up or down as aircraft altitude changes. Television camera does not change height, but shifts position and is inclined slightly for low-altitude operation. Light source illuminating map is shown at right.

## Terrain Radar Simulator Uses Television

Roseville, Md.—Pilot-navigation training devices which give a simulated flight picture of actual terrain and weather areas for both low and high altitude flight conditions will soon be delivered to the Air Force.

The all-altitude radar simulator was developed here by ACF Electronics Division of ACF Industries for use with the Republic F-105D fighter bomber which the company is building.

The ACF training device is a marked departure from previous radar simulators that used three-dimensional copies of the terrain placed under water in a large tank with an ultrasonic transducer to transmit sound waves from the water which were reflected back from the submerged model.

The new radar simulator also uses a 3-D model of the terrain to be simulated, but visible light and television cameras have now been substituted for

the more refined ultrasonic systems. The 3-D terrain-target model is constructed of thin flexible plastic and then covered with paint so that terrain and targets on the model will reflect visible light proportionately to the real terrain-target reflection of radar energy.

To simulate ground clutter return, the hills and general terrain of the model are covered with powdered black carbonaceous, while rivers and lakes are painted black to reflect no light. Concrete buildings and bridges are painted white, because they are strong radar signal reflectors, while weaker radar targets are painted grey.

The terrain-target model is illuminated by a high intensity light source which projects on a glass over the model as its position corresponds to the position of the simulated aircraft in flight, and the light source's height above the

fracture of the glass are prolonged by stress perpendicular to the direction of light passage. The result is a change in the plane of polarization.

The glass is situated between two lenses. Two lenses bend wavelets striking just the beam ends at right angles. An oscillating voltage is applied to the stocks they expand or contract. Stress is transferred through the stocks and the lenses to the glass, producing a change in its index of refraction.

The Socom system probably will be delivered to the Communications Laboratory at WADC sometime after the first of the year, although the delivery date is not yet fixed.



**SPEARHEAD INTO SPACE** Created by Aerolab, the AR02 D-4 four-stage sounding rocket is now being used by NASA for the low cost acquisition of important data at high altitudes and velocities. A wholly owned subsidiary of Ryan Aerautical Company, Aerolab has developed more space probes and rocket-powered research models, including the Mercury capsule model, which have been fired, than any other firm in the United States. Aerolab is a science team with quick reaction capabilities—a group of scientists and engineers with special talents for solving advanced problems in astrophysics, aerophysics and geophysics. Thus Aerolab's capabilities are added to Ryan's own in accomplishing breakthroughs in many vital areas of Space technology.

### THE PROBLEM SOLVERS

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## Gen. Irvine Urges Faster Economic Growth

Proposed for an increase in U.S. personal income tax by a rate of 17%, in 1973 at a total of \$10 billion, and continuing over a projected seven-year expenditure to cover that total deficit we paid off an income study made by Lt. Col. C. S. Davis (USAFA Ret.), now Auto Corp. Tax planning consultant and planning for the U.S. Senate of Calif. Sen. George L. Voinovich says the assumption of profit on which these projections are based follows:

Progress at a greater rate than any other country in the history of the world. From the depths of human misery and industrial and agricultural distress, this has made very rapid progress and can continue to do so in the future.

The report continues: "The chart shows increasing needs and calls for ample sources of housing and general transportation, but in the fields of science in the fields of transportation and health on the basis of manufacturing and production as well."

While the strong nation of the Free World has collectively worked together in NATO and SEATO, as well as United Nations, they have not been real proponents of steady expansion. In the field of the strong and growing growth of international organizations, the Free World has shown weakness, indecision, political polarization, and narrow nationalism.

The progress of our domestic free enterprise system in the last 30 years has been dynamic and remarkable. However, too many of us have become so satisfied with our own success that we have failed to observe what the other places in the world's scene have accomplished in the same time period. Almost everywhere there has been done in the last 30 years in fact, due to the Soviets starting from a much lower level of knowledge, training education and experience.

We do not publicize, as a general rule, our long-range national planning in the United States. However, we do have planning groups within our government who work in a highly classified manner on a policy or a research basis. This is the job of the Department of Defense planning.

It can become obvious with the present proposed status of the Soviet and the operating range of the Chinese, that we should plan for such a realistic economic warfare, and greatest concern for the next 30 years in the country.

Overshadowing work can done is W. H. Draper, with his presidential committee on U.S. military assistance. Of particular note were the recommendations of the National Defense Science Board established.

The Greater Research Management Institute of Technology strategy and analysis studies at Harvard and UCLA, at point to the absolute necessity for thorough long-range national planning. The only trouble with the import of these reports is that they have made

little headway classified that people in government and industry, who might find their contents useful have been unable to obtain access to them or utilize them accordingly, for commercial purposes.

### Long-Range Planning

The very formulation of the determination of the amount of our gross national product that should be devoted to our defense on a percentage basis is as a total dollar basis is the creation of a unusual plan. The planning should be done in accordance with the recommendations of a responsible permanent organization which would be part of the top management of our government.

It is felt by the author of Defense Committee on Readiness could be eliminated by this type of work. It must be established on a basis of cost/benefit with each interlocking administration. A maximum of a five-year tour out of course, continuous replacements for those who are separated for personal reasons.

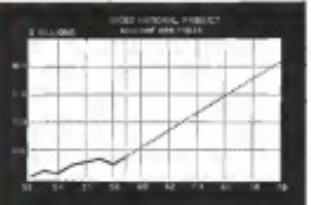
It is created that we establish within the framework of our government as a part of the office of the President, a group of older veterans, who have had extensive military service, who understand the need for proper business management of our total resources. The group would plan for the best utilization and expansion of power, transportation, material manufacturing, resources, natural resources and death and most important, the sound management of our scientific and engineering capability.

It would be the responsibility of this group, together with our political management to oversee the cash content of an up-to-date long-range economic and cultural plan for the United States and our allies in the Western world. The procedure by which such a plan would be implemented and kept up to date would best come from the recommendations of a group which includes experience in both political and business management.

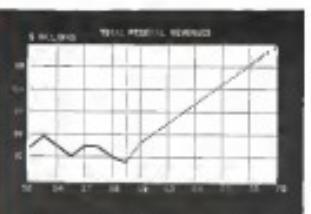
The Secretary of Defense should be nominated by a permanent board consisting of three groups of people. The first group would consist of individuals to be drawn from our three Army, Navy and Air Force officers; the second group would include some business executives, and the third, outstanding scientists. One half civilian, advice and planning comes from these areas of

## Graphs Project National Defense Costs as Related to GNP

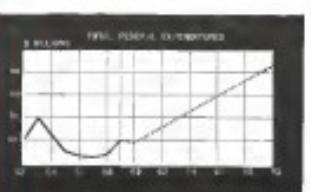
Fourteen charts covering Gen. Draper's projections of gross national product and various facets of federal spending related to it are reproduced on the following page. Gen. Draper's comments accompany each chart.



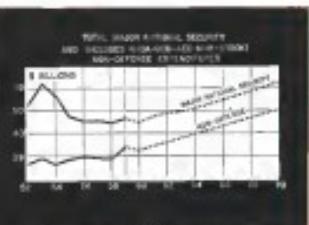
**TOTAL MAJOR historical spending** AND INCLUDES NASA-AIR FORCE-NATIONAL GUARD-DEFENSE CONTRACTORS



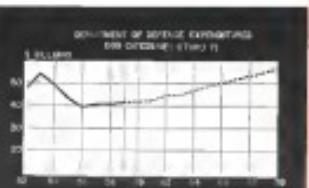
**GROSS NATIONAL PRODUCT** Based on the assumptions in Draper's study, the growth rate of 10% for the past 20 years should rise to 5% as a conservative base and with effective rates could be raised to 6% by 1981 and 7% by 2010 to reach a total of \$550 billion



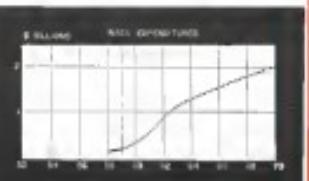
**TOTAL FEDERAL REVENUES** Projected at an average of 1.5% a year, this would permit a gradual reduction in overall debt



**TOTAL MAJOR** national security and non-defense expenditures Based on a decline from 5% of gross national product in 1950 to 7.5% in 1970, this projection is considered a bare minimum of what may be necessary to assist Congress in appropriations Increased non-defense expenditures are projected to cover for an expanding population and to protect and ensure adequate growth of the economy

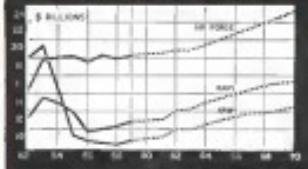


**DEPARTMENT OF DEFENSE** Based on a trend of expenditures estimated and the estimated revenue for Army, Navy, Air Force, DOD bureaus



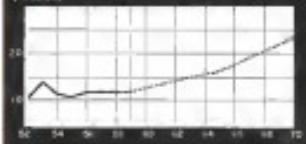
**NATIONAL AERONAUTICS AND SPACE ADMINISTRATION** expenditures. These are based on published NASA plans and progress. It covers military programs will be funded under DOD functions as they make prototype or operational stage

### ARMY-NAVY-AIR FORCE EXPENDITURES



**ARMY-NAVY-AIR FORCE EXPENDITURES.** Army estimates call for considerable moderation for research stability and advanced tool box capabilities beginning July 1967, but with a reasonable effort that effort will stay to stay it out to 1975. Navy estimates cover mostly offensive and defense equipment for aircraft and destroyers, reasonable moderation of carrier fighter leaders' effort, but a Fairey fighter refresher program at less than estimates to permit leaders of other programs like the Air Force program. Thus, the total of the Army-Navy-Air Force program is about 1/3rd of present Departmental plans. Modestions would be placed to earlier to increase modulus and reduce rates. B-73 is reflected on a weapon system basis to total four years by 1969. Tactical Air Command STOL fighters and Mobility Air Transport Service modernization is reflected. Dyna-Stat, Jason and Midas are included at rates comparable to their military partners. An Army early though emphasis is reflected such a high as 1970 because of high costs of SAGE, EMEWS and military satellite programs. By 1965, some cost reductions is expected though's duration of service usually and deployment and improved hardware requirements.

### GROUND ELECTRONICS EXPENDITURES



**GROUND ELECTRONICS** is projected now conservative basis and growth expectation are high over major rising progress.

long experience, who are at a approach the retirement age. These factors enter and estimates of nuclear expenditure are desired.

It is vitally important that the entire people fully understand that this will affect the future of our services. The more people who do know to clearly understand that they will move to their former business employment in industry after completion of their work with the government. This is necessary so as to aid the self-interest in defense that is often strongest those against people in this type of work.

Some fine work has been done in

long-range planning by some of our industrial organizations. The General Electric study group known as Tengor might well establish a pattern for what should be done on a national basis.

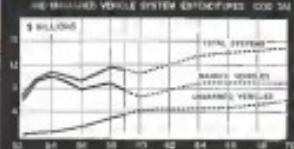
The final program of the long range planning group in the civilian sector should be a clear look at supply-side economics in our basic industries per se. A clear analysis of these things which could properly be contained in development and a much stronger replacement of these things which should be carried forward into production. These expenditures must be looked at not on the basis of what is good for the Army, Navy or the Air Force, but on a

basis of what the real mission requirements of this country are to protect our nation in the face of ever-increasing competition.

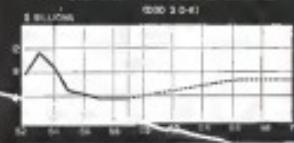
The second program of our planning group should be the determination of the various options we have available in the financial basis required to support a long term program. A broad look at 100 years in very general terms is desirable with a clear look at a 50 year program. We certainly can plan ahead for 50 years if the Russians, under Lenin, could establish a 100-year program. We must get down to preparing for the 100 year period ahead.

The third program of our industrial

### MANNED VEHICLE SYSTEMS 1960-70

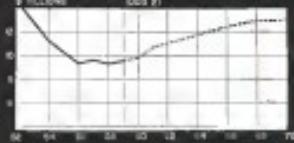


### OTHER MAJOR EQUIPMENT EXPENDITURES (1960-1970)



**MANNED AND UNMANNED** vehicle systems (above, left) and other major procurement expenditures (above, bottom). These two charts include the systems which make up that portion of the Army-Navy-Air Force expenditure chart.

### OPERATING AND MAINTENANCE EXPENDITURES



**OPERATIONS AND MAINTENANCE.** The many new systems coming into being project a strong curve into 1965. Diligent effort will be needed to hold these units in line, including scrapping of old inefficient facilities.

and military partners would be recommendations for the establishment of their systems and procedures which would enable our total gross national product to be increased to about \$1,000 billion by 1970. That is the establishment of a national goal, a goal for government and a goal for private enterprise, in local governments, with due consideration to how our private corporate system fits into the solution of specific problems that may arise. Part of the job of our joint planning group for the U.S. will be to provide solutions along the general lines of strength for the economic, military, and social organization that we have evolved in the last 100 years.

Central planning and established head of board policies for military, industrial and economic programs on a long-range national scope is essential in progress. The tendency toward the expansion of governmental bureaucracy into a static pattern of centralized control must be avoided at all cost.

### Population Factor

If we are to estimate the next decade to be one of reasonably full employment, we should not expect population expansion to be relatively stable. Increasing authorities such as the Bureau of the Census and the projections of some of the more competent of the country, it appears that we are going to have to live on the order of 215 million people in 1970. Of course, the labor force will be about 1970, and reasonably well-established, will probably be around 100 million, and therefore we should open the percentage of work force who are both willing and able to work.

The tendency toward early retirement in the past decade has been actually declining, because an increasing number of people have found it desirable to work at least on a part-time basis after reaching the age of 65. We therefore, expect a leveling off, but not a flattening out of the work force. On the other hand, almost all authorities forecast an increase in the participation rate of us citizens for the 1970 time period. We find valid projections of a total labor force of 65 billion, with 35 million in the armed forces.

It is reasonable to believe that with continuing advances and the increasing efficiency of our military organizations, we would export the Armed Forces to be reduced in about 21 nations by 1970. This could be assisted by increasing our entire Defense Department of Defense.

We have had an increase in the gross value added depreciation of plant and equipment of more than 75% since that we had in the early 1950's. It is estimated that this total valuation now stands at \$780 billion. It is believed

that the growth rate in plant and equipment during the next fifteen years will be low enough to reach a total of over \$1,000 billion.

Already capital spending for new facilities will have to go substantially above the level of the last 10 years. The trend is toward robotics and costs by increased automation and increased productivity in an effort to match the low labor costs of our foreign competitors.

The facilities available on an individual worker basis, can show an increase from a level of the order of \$11,000 per worker in 1960 to an order of \$15,000 per worker in 1970. In the past period much space in industry has been devoted to shortening working hours and about a third increasing the effective output per man-hour. Since World War II the annual increase in productive per man-hour has been on the order of 2.5% per year. This resulted in an increase in output per man-hour from \$3,700 in 1946 to \$6,000 in 1960. In the past period from 1946 to 1950, in particular, it was estimated that about 2.75% per man-hour will be attained. It will be at probability made over \$80,000 average per worker per year in 1970. This comparison is most interesting because it shows the effect of automation. It is obvious that increased automation and the application of advanced technology is the basis of our higher standard of living.

There was also it took \$2 to plant investment to produce an output of \$1. This was measured so that \$1.00 in place will produce \$1.00 output per year. It is projected that 10 years later we will produce \$1.00 of output. This shows with the overall increased industrial productivity and the higher educational and mobility level of our work force should provide a major impetus to increasing our overall rate of growth in gross national product.

The second factor which the projection of continued high growth must include the combination of the two most important and profitable aspects in my opinion, of higher output per man-hour and increasingly lower labor costs. Then we must have an effective long-range national plan that is widely disseminated and easily understood at all levels of management and base. This combination should permit early starting a closed loop in the fields of the future of R&D.

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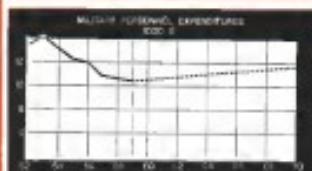
NORTH AMERICAN AVIATION



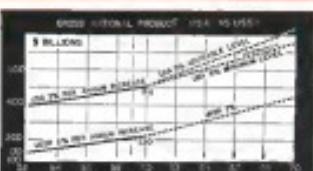
gross national product of \$550 billion by 1970.

Projection by subscribers of annual increase of our gross national product since the period 1960 to 1970 vary from a line of 15% annual per year, based on what has actually happened over the last 20 years, to projections of 12.0% annual per year, based on what has happened in the last 10 years. World War II, it is interesting to note that since 1945 there has been during a potential annual growth on the order of 4%, while other authoritative economists have considered a possible growth of at least 5% per year.

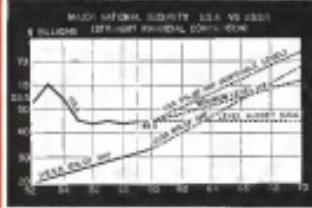
The importance of growth rates may be clarified if we consider the position of Alabamians. He said in 1959 that the planned Soviet economy, while only 40 years old, is already able to duplicate all the important economic state and corporate functions in many areas, and is surpassing us in areas they choose to select such as the space area.



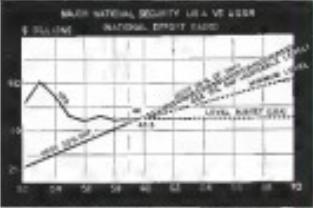
**MILITARY PERSONNEL** By decreasing diplomatic gifts and eliminating all but essential headquarters, military expenses could be reduced from 2.5 to 2.1 billion by 1970. This job must be done now or the U.S. will be exceeded by not too far, and will have a military machine not required by its enemies.



**GROSS NATIONAL PRODUCT, U.S. vs USSR** Performance of the U.S. & USSR recently repeat the Russian success in 1959, a year later the U.S. gross national product was that of Russia's in 1970. But in 1958 the U.S. gross national product was three times Russia's.



**MAJOR NATIONAL SECURITY, U.S. vs USSR** By Russia continuing 17% of gross national product investing in defense, the U.S. can eliminate Russia if it maintains its present 9% rate. The enormous level of U.S. income—7.9%—will be reflected only if Russia devotes a larger portion of its gross national product from military expenditures. Under new circumstances reduction of a constant level of defense expenditures will be around 1 month



**MAJOR NATIONAL SECURITY, actual effort basis** Russia's expenditures in the preceding chart may be misleading, they are not metric but on a national effort basis. It is indicated that the equivalent of at least 30% of the Soviet gross national product is devoted to national security, or \$45 billion in 1970. Reducing Soviet effort in 1970 from 1960 to 1970 results in a total of \$71 billion in 1970 paralleling the U.S. 9% of GNP projection.

I am sure the Russian projection is based on the fact that they are losing at an average growth rate of the U.S. of around 4% in the 1960-1970 time period with a projected average growth rate of the Soviet Union during the same period of better than 6%.

#### Possible Utilization

At the same time, the Russians are looking at a probable inflation of 8% at present reducing to about 5% in the future of our gross national product by the end of the period.

In his own projection the Soviets do not go for the order of 35% to their security program. Obviously, if that is done on the basis of conservative projections of their own, they will tend to plan to spend more for national security than we do in the period 1965 to 1970.

Since our total national production is about 10% of that of the Soviet Union, we are still in a position to dominate the world economy by maintaining our superiority both in the economic and military areas. This can be done,

however only if we concentrate our effort on maximizing the capability of our system.

This projection shows as the axis of \$575 billion by 1970. This is conservatively compared with what we could really accomplish. It appears logical that if we really go to work on this job that we could easily get \$450 billion or more in gross national product by 1970. Certainly no one can afford to be in a position where the Soviet military programs exceed our own in quality and effectiveness.

Certainly we cannot afford on a national or an international basis to just let their efforts, and more importantly, their results in space exploration to be greater than ours. These targets can be easily met by using 10% of our expanded gross national product. It is obvious that the present trends would result in about 9% of our annual product. However, if we can make the above line we reduced our national economy because our sale of weapons, the scale of living, the standard of living,

of all our people has increased annually at a much greater rate than the gross national product itself. I think most economists agree that we could spend up to 15% of gross national product for the defense success of our country without being reflected in

the increase of our defense budget.

The importance of maintaining effective language targets and long range plans is that such a procedure will allow an international basis will provide a challenge to our allies and a warning to our enemies. The growing economic and political strength of our allies will enable them to assume an increasing position in their own defense interests. They can also expand their roles in assisting in the promotion of the economic development of the countries in their own constituencies. This can be provided as incentive to the democratic system of government and the free market system of management of industry.

We can still draw upon the present Soviet threat and the future threat from China if we really have the desire to as a nation, and if we plan for that sort of action. However, there are several things we must do. We must be willing to take steps in the utilization of our resources to work toward more basic and practical products. This is quality and quantity of survival. We must be willing to pay more taxes, if necessary, to again lead in defense and space exploration, to establish a truly higher level of education of our children, and to maintain the scientific leadership of the world.

#### New Offerings

Hypotronics, Inc., Rossmfield N.J., engaged in the design, manufacture and sale of ball valves. Offering is \$1,200,000 of debentures due Jan. 1, 1971, and warrants to purchase shares of common stock of the company prior to Jan. 1, 1971. The debentures are convertible to be offered at a conversion ratio of a \$1,000 debenture and one warrant, and (2) 20,000 shares of outstanding common stock by the holders thereof. Public offering price of the debentures and warrants, terms of the warrants, and the underwriting agent to be supplied by amendment, public offering price of the common stock will be a fixed price determined by the selling stockholders and the underwriting manager. The debentures include an adjustment \$200,000 premium on the debentures, which are currently traded, which are being offered by the company, at the public offering price less the underwriting discount to dealers, officers, and employees of the company, who have disclosed an interest in the company's affairs. Proceeds of the sale of the units of debentures and warrants will be used to reduce bank bor-

rowing, which were used to pay for fixed hand improvements at the company's new Rossmfield, N.J., plant, to perform additional machinery and equipment during the last twelve months, the balance to be added to working capital.

Electroline Tube Corp., Philadelphia, Pa., engaged in the design, manufacture and sale of single and multiple-gauge cables, wire, cable channel and multiple-channel cable for tube telephones, and associated electronic devices, for use in the aircraft, mobile, cellular and other industries requiring testing of electronic data. Offering is 10,000 shares of common stock for public sale, offering price and underwriting fees to be supplied by amendment. Of the proceeds, \$100,000 will be used to acquire equipment and to begin production of high insulation magnetic tubes and outside air storage tubes. \$150,000 will be used in the cellulose division and applied toward the purchase of equipment and components for the development of wire-spiraled types of multi-channel cathode ray tube microcircuits. \$65,000 to repair existing indebtedness to Kenneth C. Marston, Sr., president, and \$25,000 to repair a loss to Helen M. Richards, his son, the balance to be added to working capital and used for general corporate purposes.

Precision-Dynamics Corp., Cincinnati, Ohio, engaged in the design, manufacture and sale of ball valves. In August, 1970, the company acquired the assets of fast division and one subsidiary of Cleveland Precision Industries, Inc., in exchange for stock properties and hardware the company acquired consists of the original division and \$1,000,000 of CPI's V-1000 indebtedness and issued to CPI 10,000 shares of common stock at the \$10.25 per share rate. The principal amount of \$1,000,000 is convertible to 100,000 shares of the company's common stock at a rate of \$100 per share. The company, pursuant to a defense contract applying products and services involving advanced technologies and requiring, in more instances, alternative manufacturing facilities or public production, to increase its rate of production to in excess of one million of an inch or less.

Offering is 171,000 shares of common stock for public sale, offering price and underwriting fees to be supplied by amendment. Proceeds will be used to pay the unpaid balance of the V-1000 indebtedness of CPI, the balance will be added to working capital.

On the proceeds from the sale of the 171,000 shares of common stock at \$4.60 per share and at prices increased 6% per annum thereafter for the first year, the underwriting firm will offer 1,000 of such shares of the public following the issuance of a prospectus at the prevailing regular price.

Anetek Corp., Boston, Mass., engaged in the design, development and manufacture of high speed paper and high speed paper tape readers for use

in association with computers and electronic data processing equipment or systems; it is also engaged in research, development, and the manufacture of other electronic and electromechanical systems and equipment. Offering is 65,000 shares of common stock. Of such stock, 55,000 shares are subject to restrictions upon transfer, the remaining 10,000 shares of which were issued attached to \$125,000 of \$450 subordinated debentures at the rate of one warrant for each 150 of debentures and 10,000 were issued to Farnam & Co., Inc., the 10,000 shares were repaid effective Jan. 5, 1969, under the Securities Act of 1933. The remaining 10,000 shares are owned by Andrew Nichols & Company and are subject to purchase by three individuals whom option has been granted for purchase at \$25 per share. Of the 55,000 shares remaining as of Sept. 1, 1970, and as of Dec. 31, 1970, and as of Dec. 31, 1971, and as of Dec. 31, 1972, a third fluctuates until their expiration. Proceeds from the sale of stock pursuant to the exercise of the warrants will be added to the company's working capital.

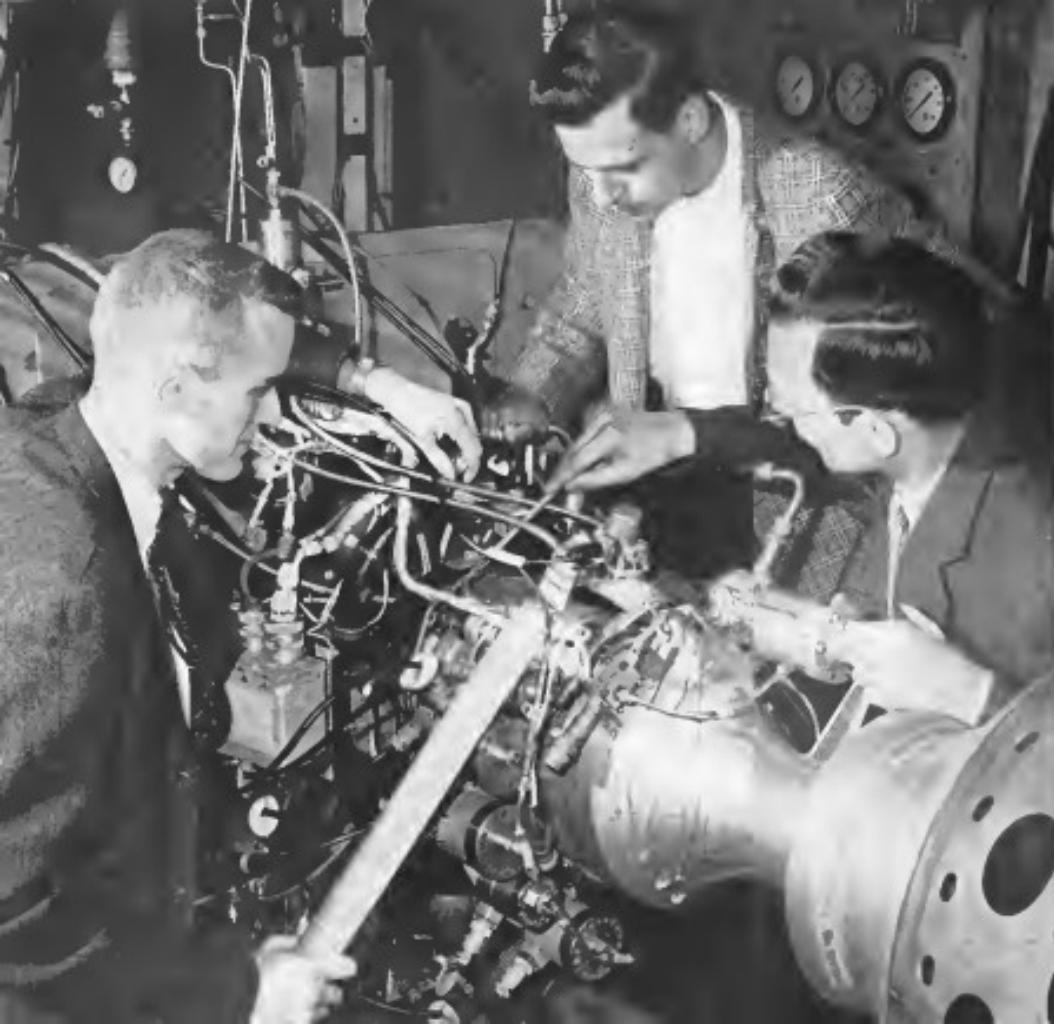
Shaw Industries, Inc., Wilmington, Del., the company was organized in November, 1960, to acquire all the issued and outstanding shares of capital stock of Shaw Engineering, Inc., a company incorporated organized in 1952, and Universal Econo Corp., a Delaware corporation organized in April, 1960. All the issued and outstanding shares of the subsidiaries were acquired in November, 1960, in exchange for a total of 200,000 shares of common stock of the company. Through its subsidiaries, the company is now engaged in the manufacture, assembly and sale of aircraft and missile components and a subsystems home, primarily for defense purpose, and in the design, engineering, manufacture and sale of aircraft, missile and space vehicles and research and development activities. The company's business is a defense contractor supplying products and services involving advanced technologies and requiring, in more instances, alternative manufacturing facilities or public production, to increase its rate of production to in excess of one million of an inch or less.

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A black and white photograph showing three men in a workshop or laboratory setting. Two men are in the foreground, focused on a complex mechanical assembly that appears to be a rocket engine or a similar high-pressure system. They are surrounded by various pipes, valves, and gauges. A third man stands behind them, also observing the work. The environment looks like a technical or industrial facility.

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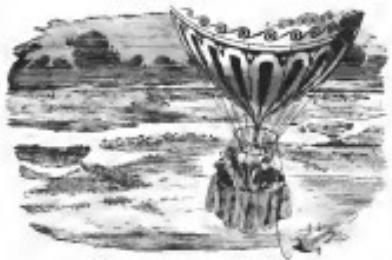
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## LETTERS

### Jet Fuel Safety

I would like to repeat on your Oct. 1 issue (p. 92), prior details of Mr. Reid's statements before the American Chemical Society, concerning the reduced number of fires resulting with kerosene fuel. I would like to make some comments of these statements. In the first of all, I would like to say this country still has about 100 aircraft in this country still have intact registrations to American Airlines (and, indeed, to most other U.S. airlines) by charter license for their home-paved routes. This is a major step forward in increasing the safety of air travel.

My comments will briefly note some areas as follows:

(1) I am impressed that for the 20 months under review Mr. Reid was able to reduce the rate of 12 aircraft on domestic flights having serious accidents. I can only imagine that that figure must reflect a large number of very minor accidents on which no one would be expected to be hurt, and also some major catastrophes such as the loss of control of the aircraft and the like. In addition, in most of the latter type, the fuel is fully redundant. Also Mr. Reid's figure, by dividing aircraft into the fuel factors accidents with far from complete fuel, make a more important measurement of human safety. Such a division probably would have resulted less than seven entries of human fuelled aircraft even though, perhaps, we give out the supports of the passengers more than the supports of the aircraft. One of the last in this category was the Pan American 747 which was lost from the sky (due possibly to a misreading of the altimeter), and although 53 occupants were killed no less than 18 escaped in a crash, if not by parachute, of the relatively slow moving aircraft. I am sure that had the aircraft been fuelled from the outside, the probability of survival would have been much greater. The point regarding of human safety, it is not as much that it is less likely to crash but rather that those saved (as in only one case by his last quote) are the sort of the individuals who are in danger there at the moment of accident.

(2) Mr. Reid is correct in stating that low figures are preferable to compare the safety of the two jet fuels in commercial operation. This is, presumably, because of the fact that the safety of JP-4 over TCA and/or their general safety record is a very high order of doubtful whether such fuel accidents as this have had can make any statistical impression.

It follows from first principles however, that JP-4 cannot be safer than TCA. However, without all relevant data it will be at a tangent about its JP-4worth. From the standpoint of tank fuel explosion in flight and on the ground (both during refueling and following a crash), JP-4 is much the safer for most environments whereas JP-4 is more dangerous than gaso-

line. Work underway at the present time is to review the cause related to the magazine's editorial column. Address letters to the Editor, *Aerospace Week*, Room 100, 600 N. Michigan Ave., Chicago, Ill. 60611. Try to keep letters under 200 words and give a precise identification. We will not print anonymous letters, but names of writers will be withheld on request.

There research has recently been undertaken both in the U.S.A. but also in Europe as well (the Shell Co.). As I understand it, the findings here are that there is a difference between kerosene and JP-4 from the particular viewpoint. If these findings are generally accepted, we should be able to dispose of this alleged hazard soon and by itself. The possibility of substantial static build-up still remains with very high rates of refueling and that must already be carefully considered. It may be that the answer is with JP-4 which is much more prone to explosive behavior than kerosene. However, this follows from basic laboratory data.

(3) Now I come to the most controversial subject, JP-4 fuel additives. First, I do not believe that the term "additives" during such operations where kerosene was not widely available within the U.S. That I understand and would accept. But I do not believe it applies to the particular case of Delta's TCA. TCA is not a basic jet fuel. In the use of JP-4, there is no doubt that kerosene is not readily available at some airports along these routes. I should very much like to see a lot of these airports, particularly in the U.S. and Canada. Whether kerosene and kerosene blends are being used over large areas of Europe, Africa and Asia for several years. In my case, since what has become clear in short order is posted to the Boston office, that, however, JP-4 is available. TCA is being used in view of this, the Ministry of Aviation has selected a wider segment of aircraft because of the greater demand for kerosene.

With regard to the article of the no-safety authorities, it is worthy of note that the chairman of the Air Registration Board has very recently determined, in particular, that JP-4 is a dangerous product of the nature of the fuel in JP-4 fuel.

I would like to add that most of the aircraft now using JP-4 have modified safety sensors, but that is part due to a matter of convenience. The most apparent reason is that the fuel tanks have been altered so that the maximum volume of the world, some of whose valves extend out lets a fuel out of the tank. A fuel tank must be regulated as a worldwide standard, and not just for JP-4.

Fuels, kerosene and the country is passed, it must be admitted that the myth of the Jet-powered Electric Car Company in September has provided the first example to date of the greater safety of kerosene. This is not to say that the JP-4 fuel research being done can be discounted that they merely belonged to American Airlines and not to one of the proponents of JP-4.

Once again, congratulations American

JP-4

Hopkins

England

### Bell Engine Story

Though Mr. Tolosa may (AW Nov. 21, p. 32) be Bell's best angle, we probably will do well.

We will be looking forward to more such inputs.

Frank Heidner

Allied Channel Corp.

New York, N.Y.



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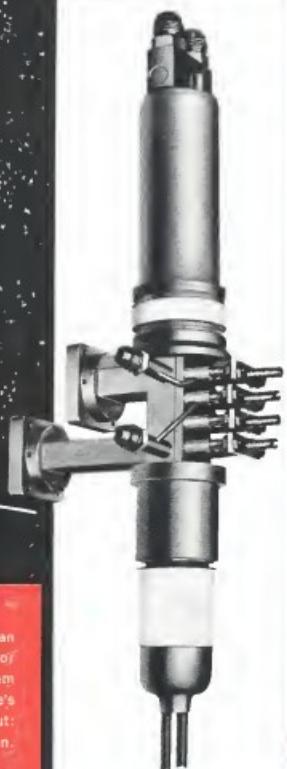
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